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Rock Products

With which is Incorporated **CEMENT and ENGINEERING NEWS**

Founded 1896

Chicago, November 27, 1926 (*Issued Every Other Week*) Volume XXIX, No. 24

MEMBER A. B. C. *The Only Paid Circulation covering the Rock Products Industry* MEMBER A. B. P.

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Rock Products

CEMENT and ENGINEERING NEWS

Volume XXIX | Chicago, November 27, 1926 | Number 24

Airplane view of Reliance Rock Co.'s plant at Azusa, Calif. Storage piles are at left; the double plant for screening stone and washing gravel is in the center and the crushing plant with the incline from the quarry is at the right

Plant of the Reliance Rock Co. at Azusa, Calif.

Notable California Sand, Gravel and Rock Operation

Reliance Rock Co.'s Plant at Azusa, Calif., Combines Crushed Stone with Sand and Gravel Production

THE plant of the Reliance Rock Co. of Los Angeles, Calif., is notable for its large production in a district where large producers are rather common. It produces steadily 60 tons per hour, and running day and night, as so many of the plants do on the Pacific coast, its total daily production would be more than 14,000 tons. The company which operates it is a subsidiary of the Coast Rock and Gravel Co. of San Francisco, which has seven other sand and gravel plants in various parts of the state.

The Reliance plant is in the San Gabriel wash, near Azusa, about 25 miles from Los Angeles. The San Gabriel wash is a very wide and long deposit of sand, gravel and boulders which has been washed from the slopes of the Sierra Nevada mountains near by. A number of plants work it for rock, sand and gravel. The largest portion of the deposit is of boulders, most of them about one-man size, so the plants are primarily rock crushing plants with gravel of secondary importance. The boulders are mainly of igneous rocks, granite perhaps predominating. They are very hard and occasion unusual wear on the crushers.

The plant began operating in the early part of the summer of 1925. The deposit was first opened by a Monighan dragline with a 5-yd. bucket at the end of a 110-ft. boom. When this machine had dug a sufficient pit two 80-B Bucycus steam shovels were put to work and it is by these that the deposit is being regularly worked.

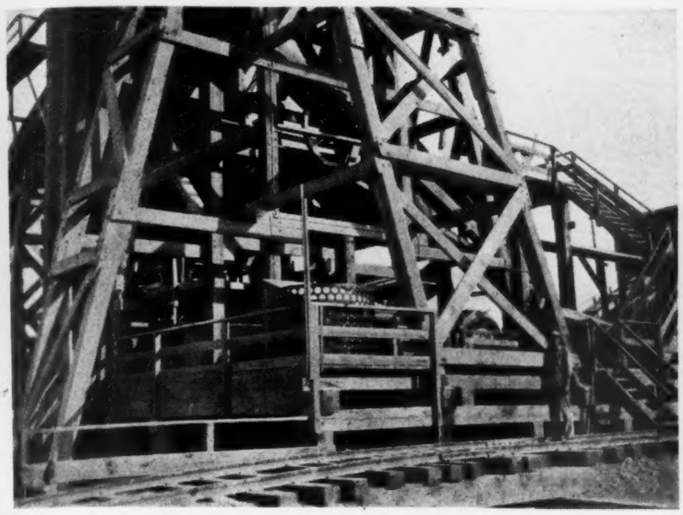
The face of the bank was 89 ft. high at the time the plant was visited, but this height is increasing as the work proceeds. Borings have established that the ground is of the same character as the surface for 387 ft. Water level is at 200 ft., so the amount of material to be recovered per acre is enormous.

The manner of working the pit is somewhat unusual. The two steam shovels stand on opposite sides of a movable hopper which is over the track that leads to the plant. They swing alternately and the dippers discharge into the hopper with almost clock-like regularity. Every two minutes the car that takes the bank material to the plant runs under the hopper and takes its load from the gate below. The hopper holds more than a carload and the gate below is very long so that the car is filled quickly. This gate is a double horizontal door, the flaps being opened and closed by a rope and pulley system.

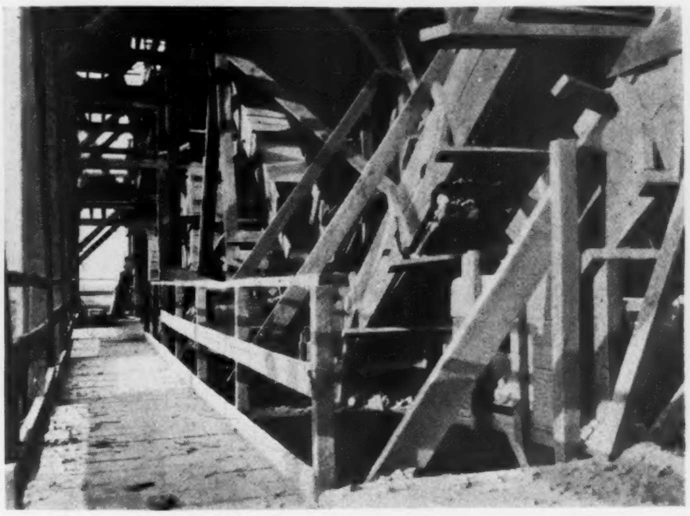
The car was made by the Pacific Car and Foundry Co. and it holds 50 tons. This is

The unique method by which the bank is excavated by two steam shovels working as a unit

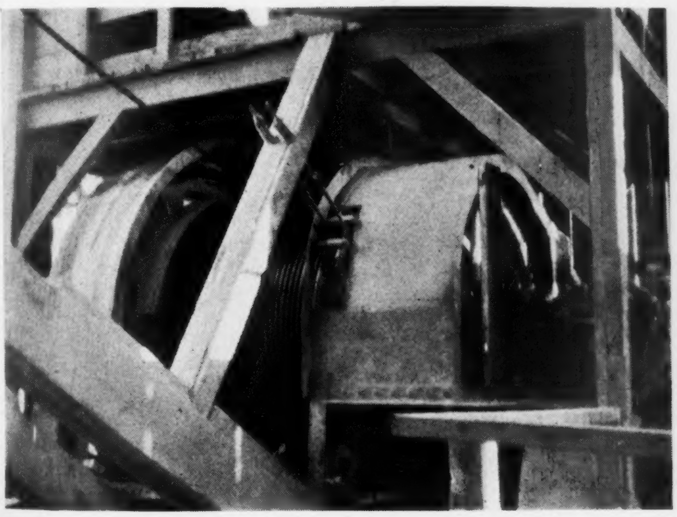
unusually large for a car to be pulled up the plant incline and many companies have hesitated about installing so large a unit for fear it would give an unfavorable load factor where electric power was furnished. But with the heavy power consumption used in rock crushing and other parts of the work the load factor is not seriously lowered in this case. The hoist is of 300 hp. and has two speeds. The high speed is used while the car is on the flatter section of the track in the pit and the low speed when it reaches the incline that leads to the plant. This hoist was made by the Golden Gates Iron Works of San Francisco. The cable is 1½



Crushing plant in foot of tower at end of incline from pit

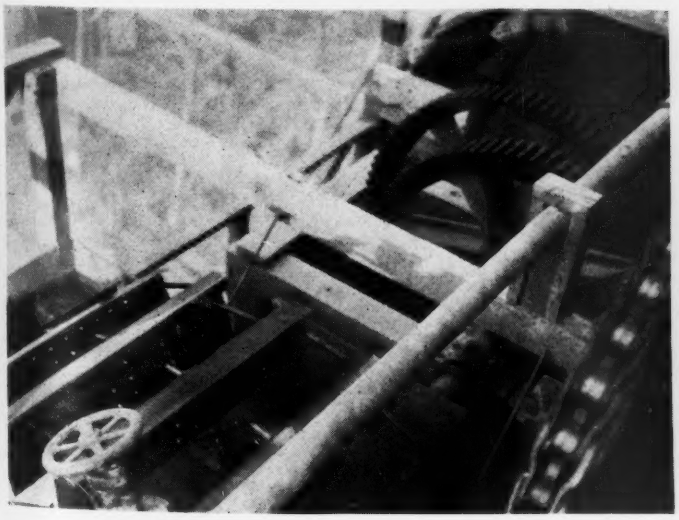


The vibrating screen deck on crushed stone side of screening plant

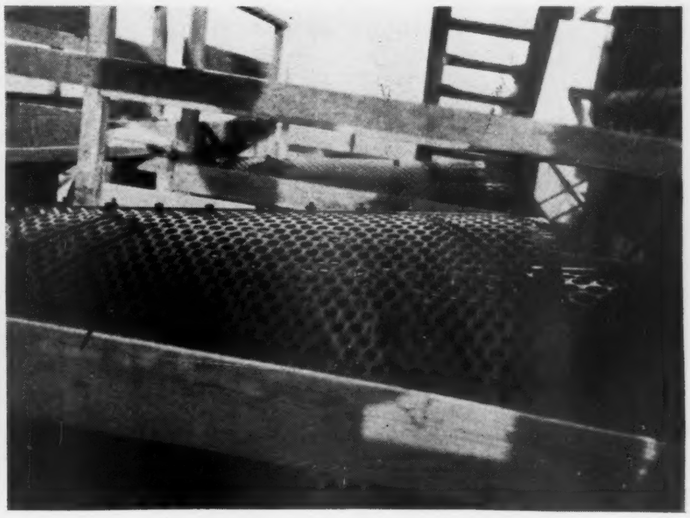


The double-drum hoist that pulls the 50-ton car from the hopper

Stones passing the finger chute (center of picture) and falling into crusher



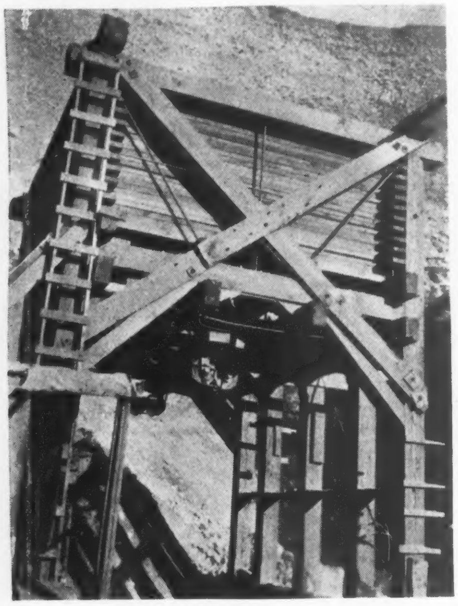
Looking down on the sand wheel and its drive



The double-jacketed conical screens for gravel washing

in. in diameter and the two speeds are 1760 ft. per minute (20 miles per hour) and 175 ft. per minute.

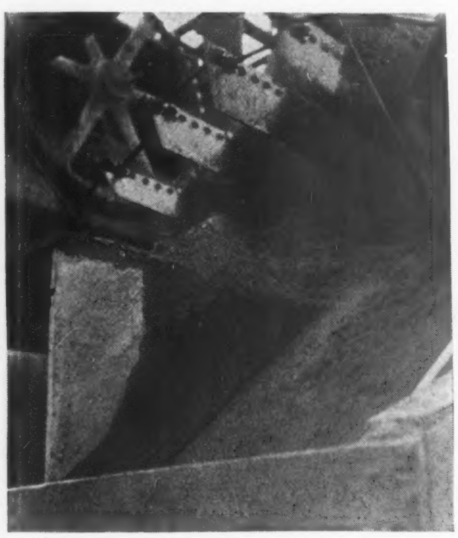
The car dumps into a hopper and the material flows through a "finger gate" to the



Shovel hopper showing flap gate pulleys beneath

primary crusher. The "fingers" are pieces of rail about 3 ft. long hung at the top and free to swing. They check the rush of material and allow it to flow more steadily to the crusher.

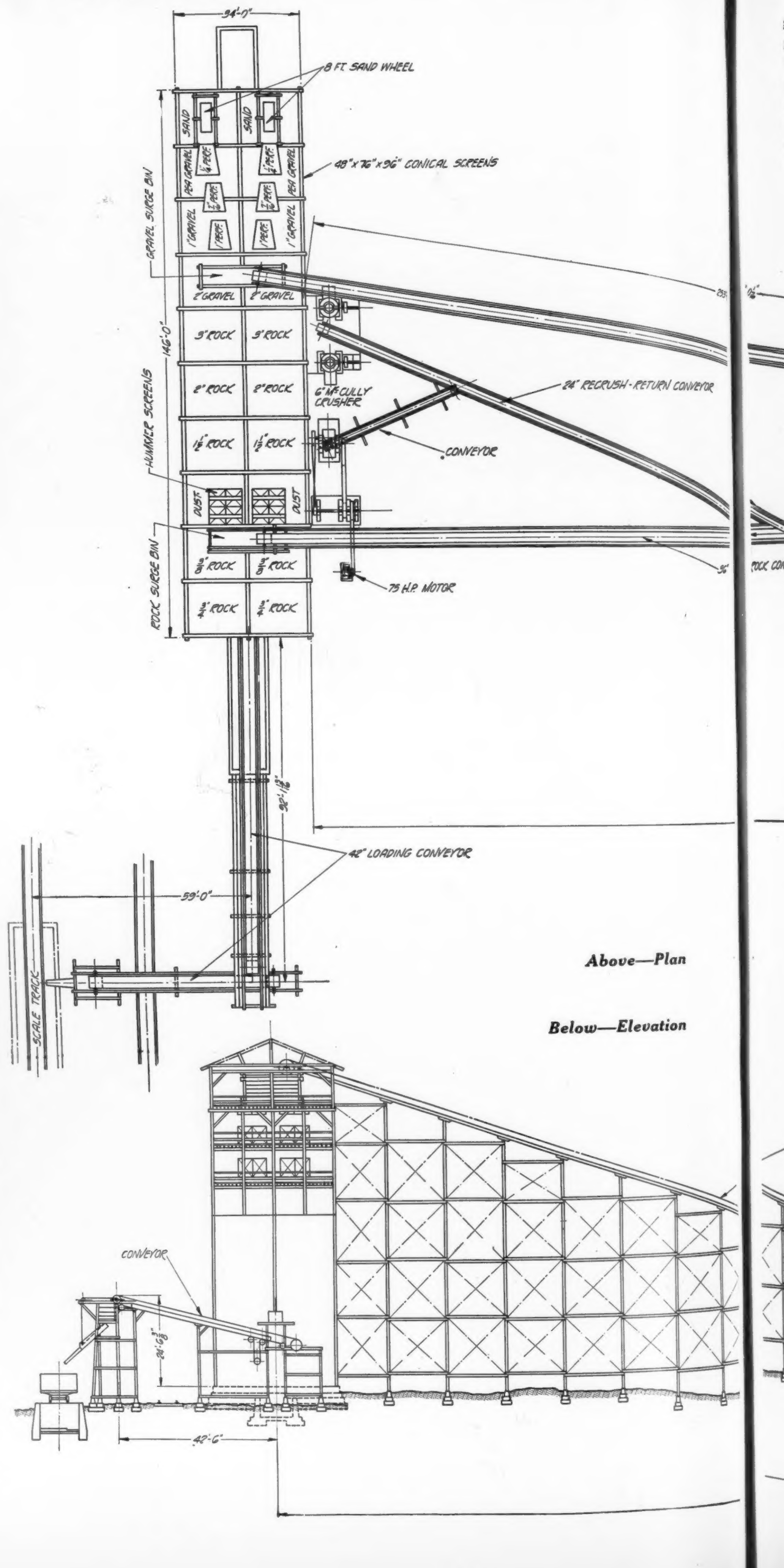
This primary crusher is a No. 15 Allis-Chalmers Type N. The discharge of the crusher goes to two 60-in. by 20-ft. Allis-Chalmers screens. Oversize of these screens goes to two No. 6 type N crushers and four No. 6 McCully gyratories. These crushers



Discharge chute of a sand wheel

are below the floor and at the time the plant was visited they were working completely buried in the feed and Mr. Vaughn, the superintendent, said that that was the usual condition.

The scalping screens really split the bank run into two materials—crushed rock and



Above—Plan

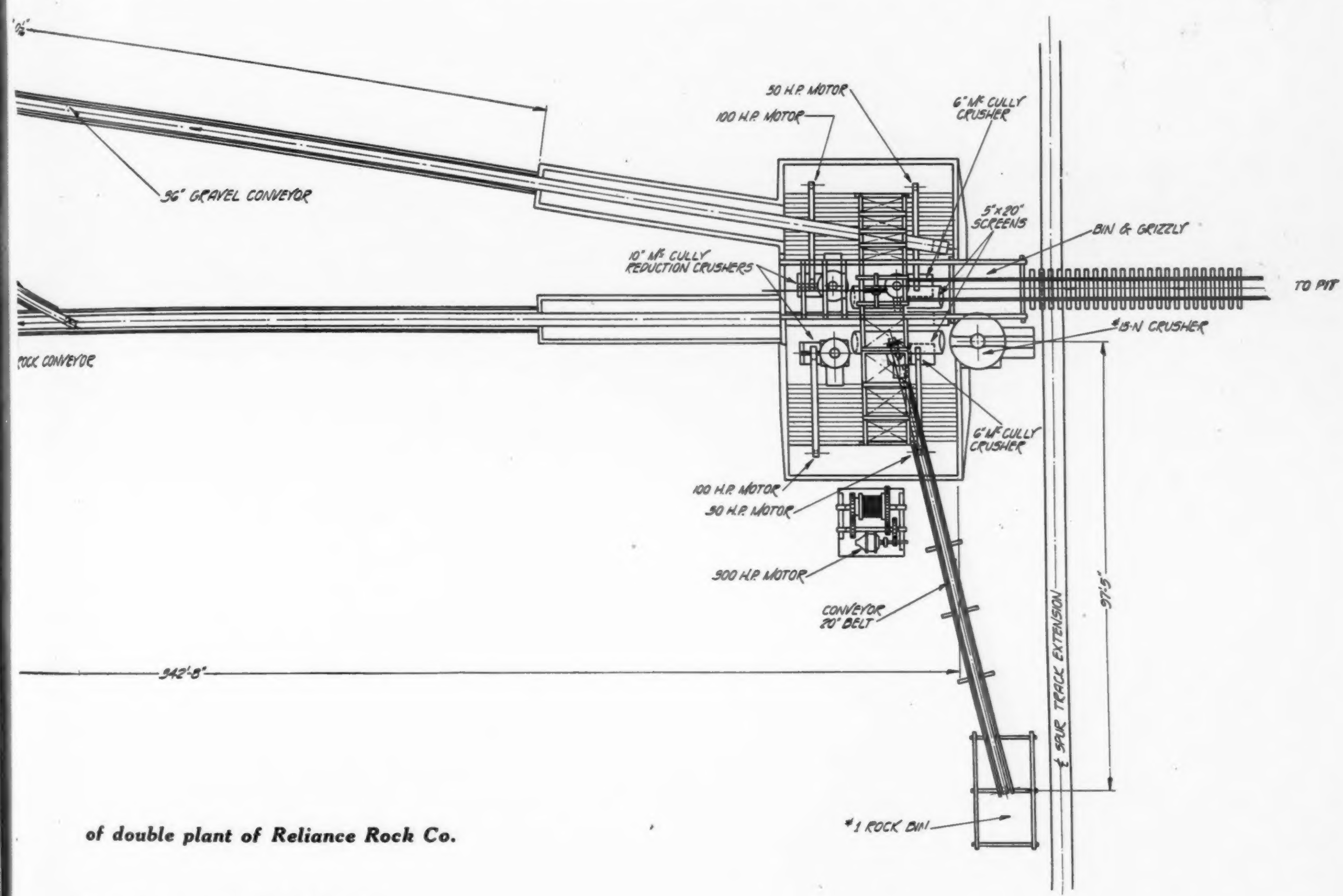
Below—Elevation

gravel and sand. Everything under 2 in. is gravel and sand and goes to a washing and wet screening plant. Everything over 2 in. after passing the crushers goes to a rock screening plant to be dry screened. There are two belts, one for gravel and sand and one for rock, and each is 36 in. wide and has 385-ft. centers.

The rock screening and the gravel washing plants are placed side by side on top of the storage bins. On the rock side there are 22 "Hum-mer" screens, each 4x5 ft. of the new 332 type. These make the usual commercial sizes of crushed stone from 2 in. down to "road dressing," which is ¼ in. and finer. The oversize goes to a pair of 40 in. rolls with 20 in. faces and is crushed and then elevated to the battery of "Hum-mer" screens.

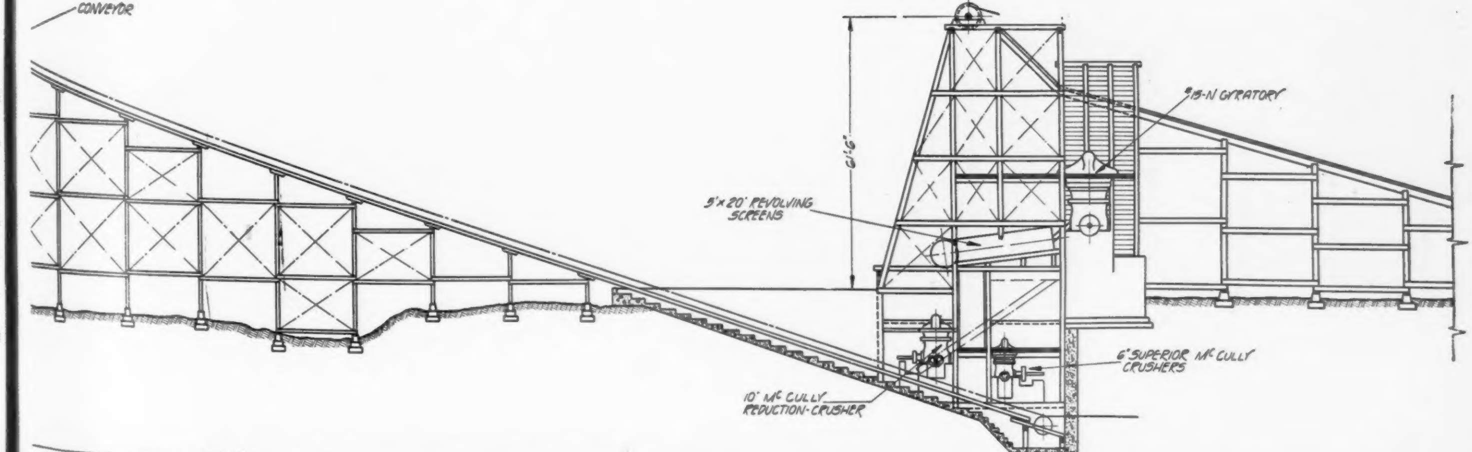
The sand and gravel go to six Allis-Chalmers conical screens with double jackets. Here water is added, 1500 gal. per min. being used. This is furnished by a Kimball pump which draws its supply from wells below the plant in the "wash."

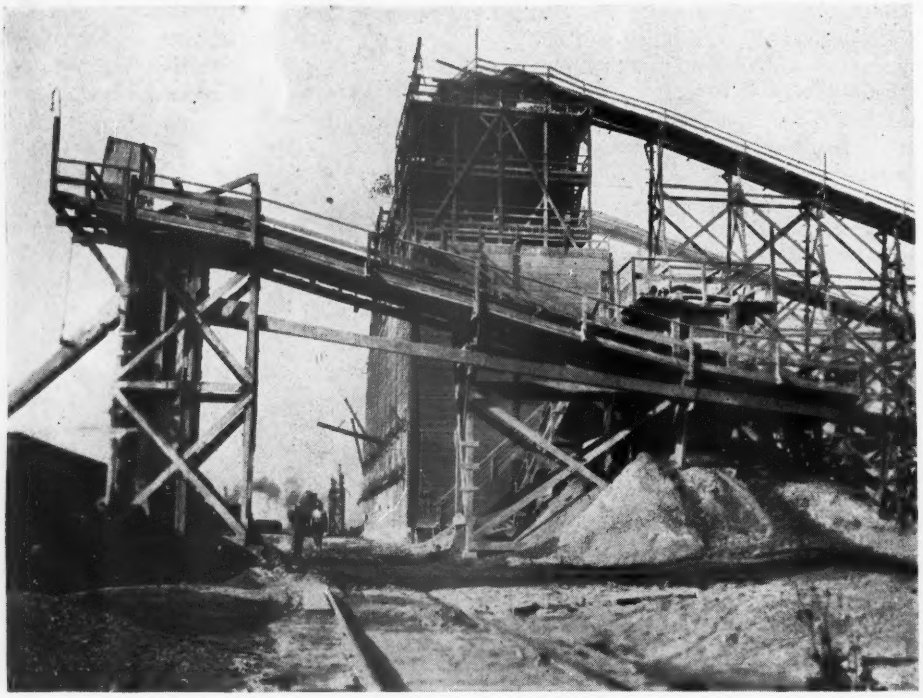
Two sizes of gravel from the first screen go to bins. The undersize of the outer jacket goes to three more screens of the same type but with finer perforations. The undersize of this screen is sand, which is recovered by sand wheels. These are wheels with buckets that lift the sand from a box through which the current of sand and water flows and deposit it in a chute through which it flows to the sand bins. There are two of these wheels. They were invented by



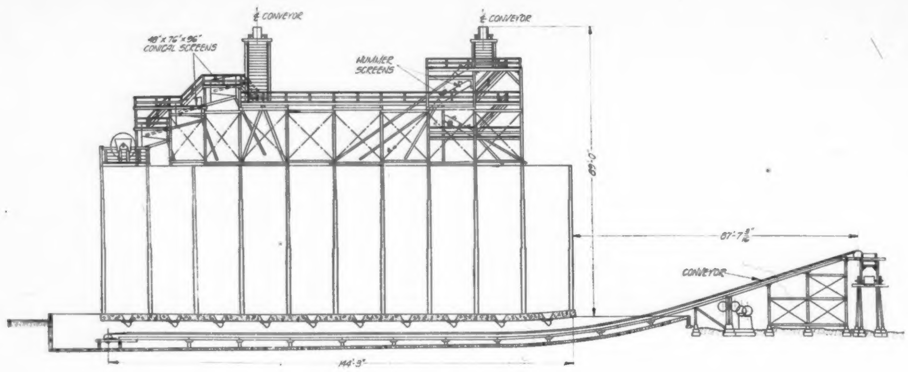
of double plant of Reliance Rock Co.

of rock screening side of plant





End of plant showing swinging chute for car loading



Elevation of bin

A. D. Hadsel, operating manager of the company.

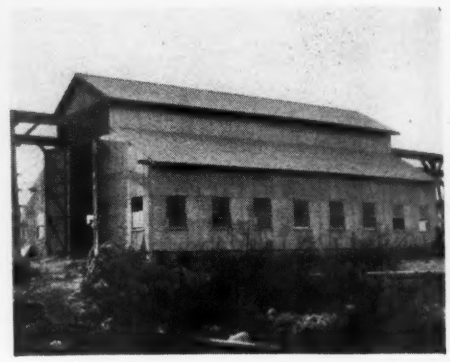
The loading arrangements at the plant are excellent. All shipments are made by rail and cars may be loaded in the usual way from chutes that lead from the bins. But in addition they may be loaded by a belt conveyor arranged so that one or more sizes of gravel, or a mixture of sand and gravel, may be loaded at the same time. This conveyor elevates the material to a box above the car to be loaded and from this box a swinging chute is hung that moves back and forth when the conveyor runs and thus spreads the material across the width of the car. In this way the load is equalized and the material is thoroughly mixed.

While this plant is especially adapted to southern California conditions, there are many features that are worth studying by those who operate plants in other localities. The method of dividing the product at the start and separating the stone and gravel plants, the crushing and recrushing system and the loading are arrangements all noteworthy.

The offices of the company are in Los Angeles, where the company has a large bunker and operates its own delivery system. C. B. Rogers is manager and R. E. Vaughn is superintendent in charge of operation.

Safety Activities in the Quarry Industries

ARTICLES on safety in the quarry industry make up the entire contents of the October issue of *Labor and Industry*, published by the Pennsylvania Department of Labor and Industry. There are interesting contributions by many prominent safety men in the rock products industries. A list of some of these articles includes: "Safety Activities of the Lawrence Portland Cement Co.," by D. Adam; "Atlas Portland Cement Co.'s Safety Activities," by Alex. Morrow; "Safety in the Quarries of the Alpha Portland Cement Co.," by B. E. Williams; "Accident Records of the Alpha Portland Cement Co.," by J. L. White; "How the American Lime and Stone Co. Has Organized for Safety," by A. C. Hewett; "Explosives—Handle with Care," by T. J. Quigley; "Preparing Regulations for Pits and Quarries," by J. M. Sandel, and "Crane Safety for the Operator," by W. F. Mackenzie.



Machine shop at the Azusa plant of Reliance Rock Co.

Dr. R. H. Lansburgh, secretary of the Department of Labor and Industry, Pennsylvania, states that there is a limited number of this booklet available, on application, to all rock products operators who are interested.

Los Angeles office of the company

Some Properties of Gypsum-Lime Mixes*

A Study Covering the Addition of Gypsum to Both Hydrate and Quicklime in All Percentages

By L. E. Smith

Bureau of Standards, Department of Commerce, Washington, D. C.

IN plastering it is common practice to use a mixture of calcined gypsum and lime putty for finish coat work. This gypsum-lime mix will vary in composition within quite wide limits in accordance with the ideas of different workmen as to the proper proportions. The governing factors in making this mix are in most cases workability and a relatively quick set of the mortar. Some plasterers prefer to secure quicklime and slake it on the job, while others use hydrated lime which has been soaked over night.

The purpose of the investigation herein reported was to determine some of the physical properties of gypsum-lime mixes without confining the scope of the work to the compositions used in practice but extending the work to cover all percentages from 100% calcined gypsum to 100% lime, varying these percentages by 5% increments with each mix.

The materials employed consisted of one brand of calcined gypsum of the grade usually employed in finish coat work, one high calcium quicklime (quicklime No. 1) and one finishing hydrate (hydrate No. 1), procured in the local market. In addition a magnesian quicklime (quicklime No. 2) and a finishing hydrate (hydrate No. 2) made at the same plant from similar rock were secured to give a direct comparison of the properties of the two materials.

The properties of the mixes studied were: time of set, tensile and compressive strength, volumetric shrinkage and plasticity. All mixes were based upon percentages by weight and for test purposes all were brought to a consistency which gave a 20 m.m. penetration of the 30 g. modified Vicat needle.[1] This is the A.S.T.M. standard testing consistency for lime paste.

The procedure followed in making up the mixes in the case of hydrated lime was to mix the hydrate with water to a thick paste and, allowing it to stand over night, the container being covered with a damp cloth. With the quicklimes the required amount was slaked with water in the manner most suitable to the quicklime in question. It was then mixed to a stiff paste and allowed to stand over night under the same conditions as the hydrated lime putties. In the tables the amount of water per 100 g. of the dry materials includes the hydration water of the quicklimes. Three test specimens for each mix were made and tested after 28 days' air storage in the laboratory. Shrinkage determinations were made on specimens cast in brass forms approximately 3 in. square and ¾ in. high. The volume of the forms was accurately determined and used as the volume of the specimen before setting. In measuring the volume of the specimen at 28 days, the average of three length and breadth measurements and the average of

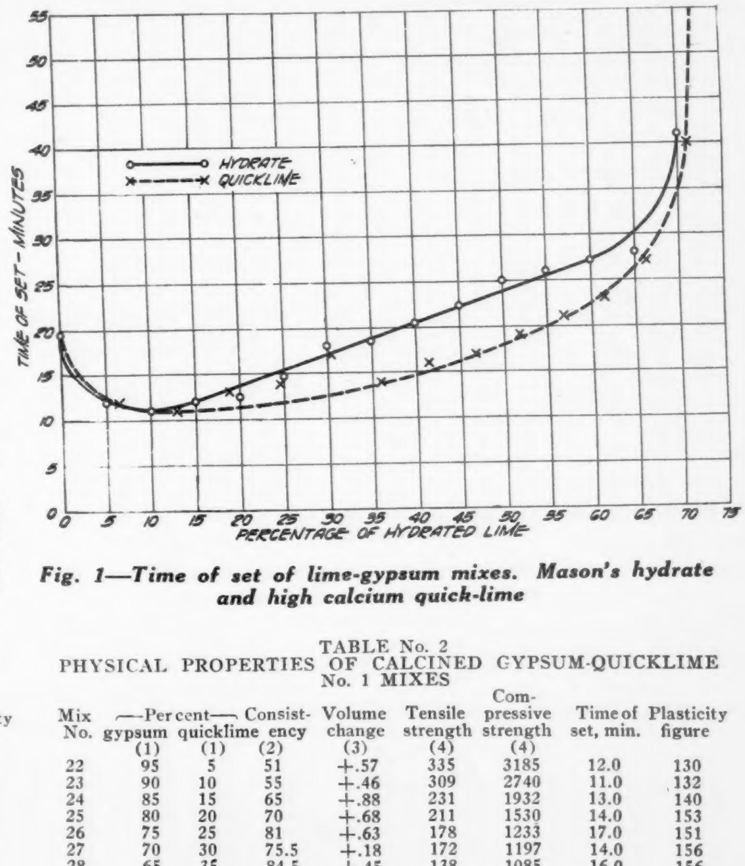


Fig. 1—Time of set of lime-gypsum mixes. Mason's hydrate and high calcium quick-lime

[1]Standard specifications for Hydrated Lime for Structural Purposes (Serial Designation C6-24), A. S. T. M. Standards, 1924.

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TABLE No. 1
PHYSICAL PROPERTIES OF CALCINED GYPSUM-HYDRATE No. 1 MIXES

Mix No.	Per cent gypsum (1)	Per cent hydrate (1)	Consistency (2)	Volume change (3)	Tensile strength (4)	Compressive strength (4)	Time of set, min.	Plasticity figure
1	100	0	45	+.69	359	3250	19.5	131
2	95	5	46	+.18	400	2975	12.0	160
3	90	10	47	+.87	384	2820	11.0	163
4	85	15	48	+.74	358	2696	12.0	170
5	80	20	49	+.64	402	2507	12.5	172
6	75	25	51.5	+.81	275	2443	14.5	178
7	70	30	53.5	+.44	262	2007	18.0	181
8	65.	35	55.5	+.68	260	1366	18.5	185
9	60	40	57.5	+.79	240	1285	20.5	189
10	55	45	60	+.47	201	960	22.0	194
11	50	50	61.5	+.55	177	832	25.0	213
12	45	55	63	+1.58	165	799	26.0	217
13	40	60	65	+.50	143	760	27.0	231
14	35	65	68	+1.15	112	610	28.0	250
15	30	70	72	+.19	105	496	41.0	273
16	25	75	74	+.50	98	599		272
17	20	80	77	—.79	85	455	Indefinite	285
18	15	85	79	—2.18	79	357		290
19	10	90	81.5	—7.35	74	310		302
20	5	95	82.5	—16.42	59	213		318
21	0	100	89.5	—27.41	82	282		338

(1) By dry weight.
(2) Water, c.c. per 100 grams dry material.
(3) Twenty-eight days, per cent.
(4) Twenty-eight days, lb. per sq. in.

TABLE No. 2
PHYSICAL PROPERTIES OF CALCINED GYPSUM-QUICKLIME No. 1 MIXES

Mix No.	Per cent gypsum (1)	Per cent quicklime (1)	Consistency (2)	Volume change (3)	Tensile strength (4)	Compressive strength (4)	Time of set, min.	Plasticity figure
22	95	5	51	+.57	335	3185	12.0	130
23	90	10	55	+.46	309	2740	11.0	132
24	85	15	65	+.88	231	1932	13.0	140
25	80	20	70	+.68	211	1530	14.0	153
26	75	25	81	+.63	178	1233	17.0	151
27	70	30	75.5	+.18	172	1197	14.0	156
28	65	35	84.5	+.45	138	1085	16.0	156
29	60	40	98	+.95	103	672	17.0	162
30	55	45	108	+.22	89	670	19.0	173
31	50	50	112	+.64	103	825	21.0	180
32	45	55	118	+.34	82	547	23.0	186
33	40	60	121	+.05	64	366	27.0	194
34	35	65	126	—.05	52	341	40.0	195
35	30	70	138	—.57	35	275	110.0	193
36	25	75	152	—1.33	28	172		193
37	20	80	159	—4.18	46	238	Indefinite	193
38	15	85	174	—9.73	43	205		192
39	10	90	167	—12.45	35	206		196
40	5	95	181	—20.02	34	206		211
41	0	100	172	—25.08	25	228		221

(1) By dry weight.
(2) Water, c.c. per 100 grams dry material.
(3) Twenty-eight days, per cent.
(4) Twenty-eight days, lb. per sq. in.

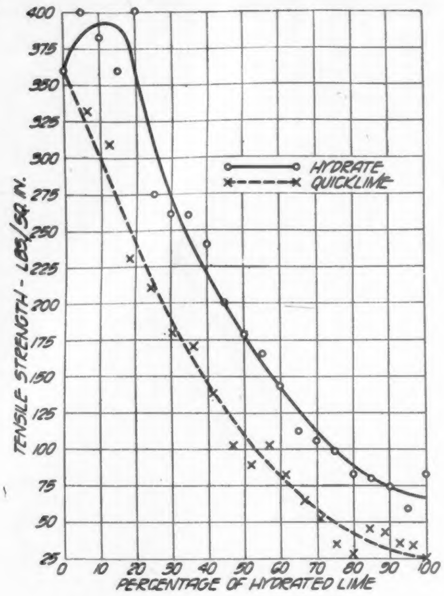


Fig. 2—Tensile strength of lime-gypsum mixes. (Mason's hydrate and high calcium quick-lime)

five height determinations were used. Measurements were made using a vernier reading to 0.002 cm. A specimen of this shape eliminated the unequal shrinkage found when cubes are employed.

Tensile strength measurements were made in the usual manner, using three briquettes and recording the average.

Compressive strength tests were made on

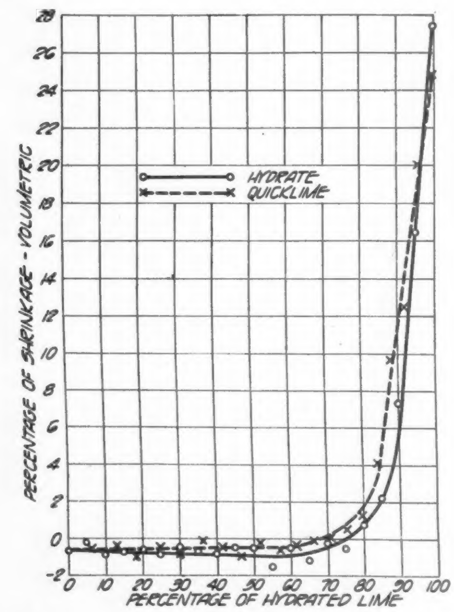


Fig. 4—Shrinkage of lime-gypsum mixes. (Mason's hydrate and high calcium quick-lime)

three specimens cast in 2 in. cubes and the average unit strength reported. With the mixes rich in lime there was in some cases considerable shrinkage. In order to get true bearing surfaces two opposite faces were ground plane. The specimens high in lime content varied in dimensions because of shrinkage. However, no corrections were made for these changes and high values were recorded attributable to the decrease in height of the specimens.

The time of set was measured by means of the Vicat needle.[2]

The plasticity figure for all the mixes was determined on the Emley plasticimeter[3]

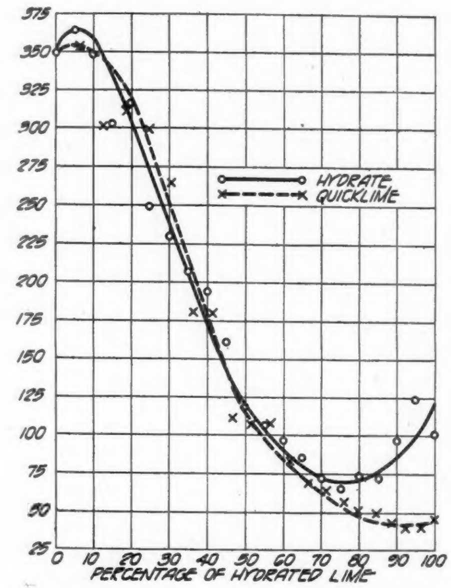


Fig. 7—Tensile strength of lime-gypsum mixes. (Finishing hydrate and quick-lime from similar stone)

and was calculated from the formula $P = \sqrt{F^2 + (10T)^2}$, in which P is the plasticity figure, F is the scale reading at the end of the experiment and T is the duration of the experiment in minutes.

The results obtained in this work are given in Tables 1, 2, 3 and 4 and graphically

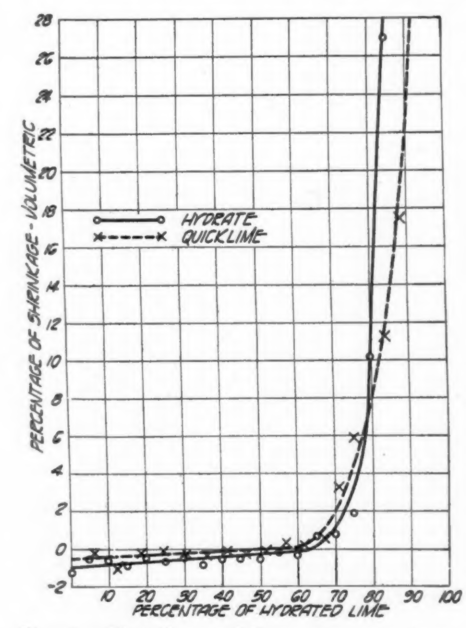


Fig. 9—Shrinkage of lime-gypsum mixes. (Finishing hydrate and quick-lime from similar stone)

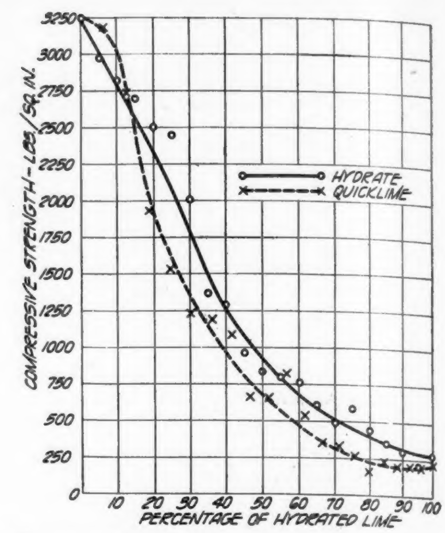


Fig. 3—Compressive strength of lime-gypsum mixes. (Mason's hydrate and high calcium quick-lime)

in Figs. 1 to 10. In plotting the results calculations were made to express as percentages hydrated lime, the amount of quicklime in the mix. This was done to make the results more comparable.

Figs. 1 and 6 show that quicklime and hydrate in amounts of about 10% accelerate most markedly the time of set of calcined gypsum. However, when the percentage of lime exceeds approximately 50%, retardation occurs.

Figs. 2 and 7 show that in small amounts hydrated lime increases the tensile strength of the mix. The quicklime does not exhibit

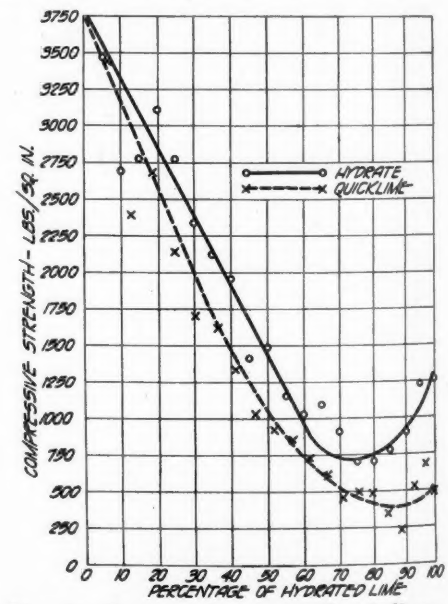


Fig. 8—Compressive strength of lime-gypsum mixes. (Finishing hydrate and quick-lime from similar stone)

this property. These same figures also show that mixes rich in hydrate have a somewhat greater tensile strength than those mixes where quicklime is substituted to give an equivalent hydrate content.

Figs. 3 and 8 show that the addition of lime to calcined gypsum in all cases lowers the compressive strength. In Fig. 8 the

[2]Standard Specifications and Tests for Portland Cement (Serial Designation C9-21), A. S. T. M. Standards, 1924.

[3]Standard Specifications for Hydrated Lime for Structural Purposes (Serial Designation C6-24), A. S. T. M. Standards, 1924.

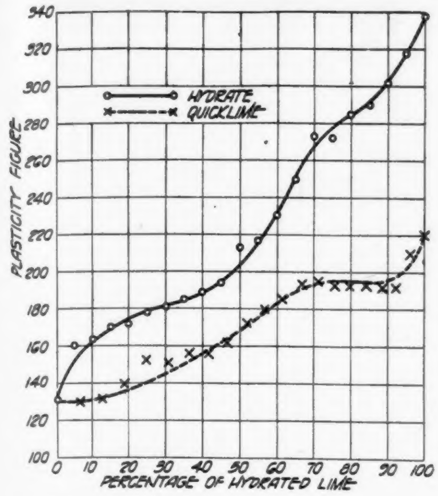


Fig. 5—Plasticity of lime-gypsum mixes. (Mason's hydrate and high calcium quick-lime)

apparent rise in the curves as the lime content approaches 100% probably may be attributed to excessive shrinkage of the test specimens. It is seen from Fig. 8 that the compressive strength of gypsum is reduced less by additions of hydrate than by additions of quicklime from the same stone where the hydrate is equivalent.

Figs. 4 and 9 show that there is a definite mix beyond which an increase in lime content gives rise to shrinkage. This mix seems to be somewhat dependent on the ultimate shrinkage of the neat lime. The greater the ultimate shrinkage the greater the percentage of gypsum necessary to prevent shrinkage. There appears little difference between mixes made from hydrate and those made from quicklime (Fig. 9) when based upon equivalent hydrate content.

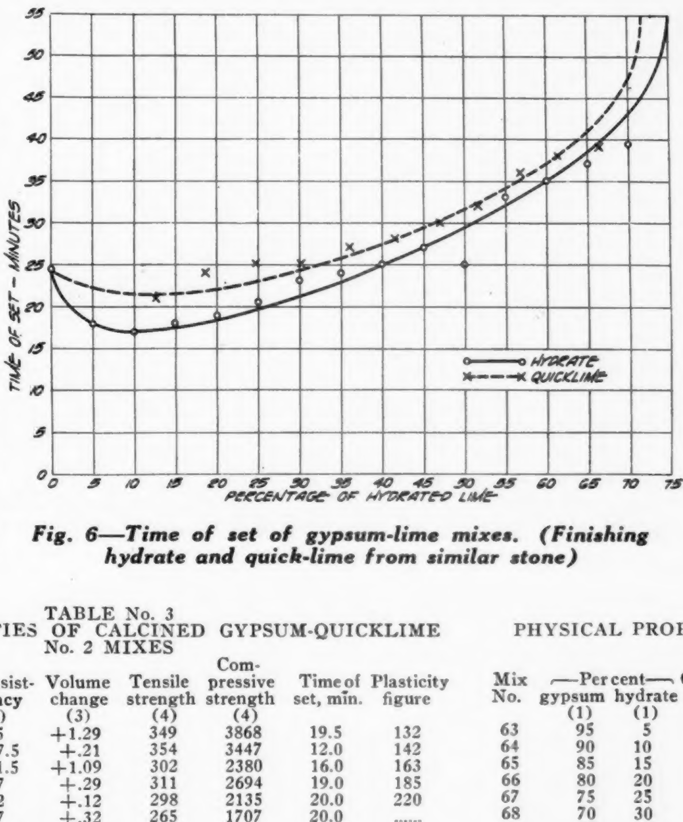


Fig. 6—Time of set of gypsum-lime mixes. (Finishing hydrate and quick-lime from similar stone)

Figs. 5 and 10 show that with an increase in percentage of lime there is an increase in the plasticity figure. Using a finishing lime, from a plasticity standpoint alone, it appears that mixes richer in gypsum than those at present employed (25 to 30%) could well be used without a material sacrifice in plasticity.

In view of the results obtained in this investigation it is believed that the following conclusions are justified:

1. Quicklime and hydrated lime when added in small amounts to calcined gypsum accelerate the time of set. Maximum acceleration occurs when about 10% by weight of hydrated lime is present. Above 50% hydrated lime, retardation occurs which becomes marked at about 70%, when the time of set approaches that of pure lime.

2. Hydrated lime in small amounts increases the tensile strength of calcined gypsum; amounts in excess of 20% decrease the tensile strength. A calcined gypsum-hydrated lime mix rich in hydrate (in excess of 85%) has a greater tensile strength than a mix of like composition containing an equivalent amount of quicklime.

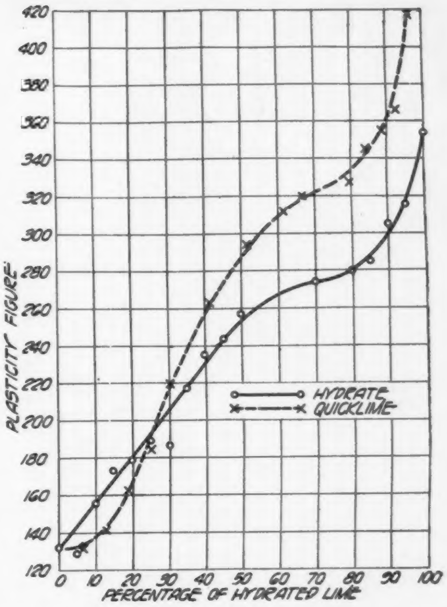


Fig. 10—Plasticity of lime-gypsum mixes. Finishing hydrate and quick-lime from similar stone)

3. The addition of lime to calcined gypsum in all amounts lowers the compressive strength. The compressive strength of a gypsum-hydrate mix is greater than that of a gypsum-quicklime mix where the lime content is equivalent.

4. A definite amount of lime may be added to calcined gypsum without affecting the shrinkage on setting, but lime in excess of this amount increases the shrinkage.

5. Lime in all proportions increases the plasticity of calcined gypsum.

Bulletin on Lime Mortars

BULLETIN No. 316, issued by the National Lime Association, has the title: "The Fallacy of Unnecessary Strength," and is devoted to showing that lime mortar is sufficiently strong for all ordinary brick work. The book is well printed and illustrated. An appendix gives data on the strength of brick walls.

TABLE No. 3
PHYSICAL PROPERTIES OF CALCINED GYPSUM-QUICKLIME No. 2 MIXES

Mix No.	Per cent gypsum (1)	Per cent quicklime (1)	Consistency (2)	Volume change (3)	Tensile strength (4)	Compressive strength (4)	Time of set, min.	Plasticity figure
42	100	0	45	+1.29	349	3868	19.5	132
43	95	5	47.5	+.21	354	3447	12.0	142
44	90	10	51.5	+1.09	302	2380	16.0	163
45	85	15	57	+.29	311	2694	19.0	185
46	80	20	62	+.12	298	2135	20.0	220
47	75	25	77	+.32	265	1707	20.0	......
48	70	30	82.5	+.38	181	1618	22.0	263
49	65	35	91.5	+.12	180	1344	23.0	......
50	60	40	95	+.30	112	1038	25.0	......
51	55	45	102.5	+.07	108	924	27.0	295
52	50	50	102.5	—.34	112	850	31.0	......
53	45	55	117	—.26	83	730	33.0	311
54	40	60	114	—.68	69	609	34.0	......
55	35	65	121	—3.27	64	468		320
56	30	70	130	—5.86	57	500	Indefinite	......
57	25	75	132	....	51	492		328
58	20	80	137.5	—11.26	50	350		345
59	15	85	141	—17.51	43	242		355
60	10	90	157	—35.12	40	532		367
61	5	95	165	—38.37	40	691		418
62	0	100	175	—42.53	46	497		430

(1) By dry weight.
(2) Water, c.c. per 100 grams dry material.
(3) Twenty-eight days, per cent.
(4) Twenty-eight days, lb. per sq. in.

TABLE No. 4
PHYSICAL PROPERTIES OF CALCINED GYPSUM-HYDRATE No. 2 MIXES

Mix No.	Per cent gypsum (1)	Per cent hydrate (1)	Consistency (2)	Volume change (3)	Tensile strength (4)	Compressive strength (4)	Time of set, min.	Plasticity figure
63	95	5	47	+.60	364	3473	13.0	129
64	90	10	50	+.62	348	2683	12.0	156
65	85	15	52	+.88	303	2772	13.0	173
66	80	20	52	+.46	317	3104	14.0	179
67	75	25	54	+.66	249	2770	16.0	189
68	70	30	57	+.42	231	2345	18.0	187
69	65	35	58.5	+.82	212	2124	19.0	217
70	60	40	61	+.48	188	1957	20.0	235
71	55	45	66	+.49	161	1418	22.0	244
72	50	50	68.5	+.56	119	1492	20.0	257
73	45	55	71	+.18	107	1158	28.0	......
74	40	60	75.5	+.29	97	1028	30.0	......
75	35	65	77	—.65	86	1108	32.0	......
76	30	70	83.5	—.74	72	865	34.0	274
77	25	75	86	—1.90	66	708		......
78	20	80	91	—10.11	73	704	Indefinite	280
79	15	85	95	—17.48	72	788		285
80	10	90	100.5	—26.95	97	908		305
81	5	95	103	—36.18	124	1230		316
82	0	100	107	—43.45	101	1261		354

(1) By dry weight.
(2) Water, c.c. per 100 grams dry material.
(3) Twenty-eight days, per cent.
(4) Twenty-eight days, lb. per sq. in.

Combination of Pumping and Sluicing for Recovering Sand and Gravel

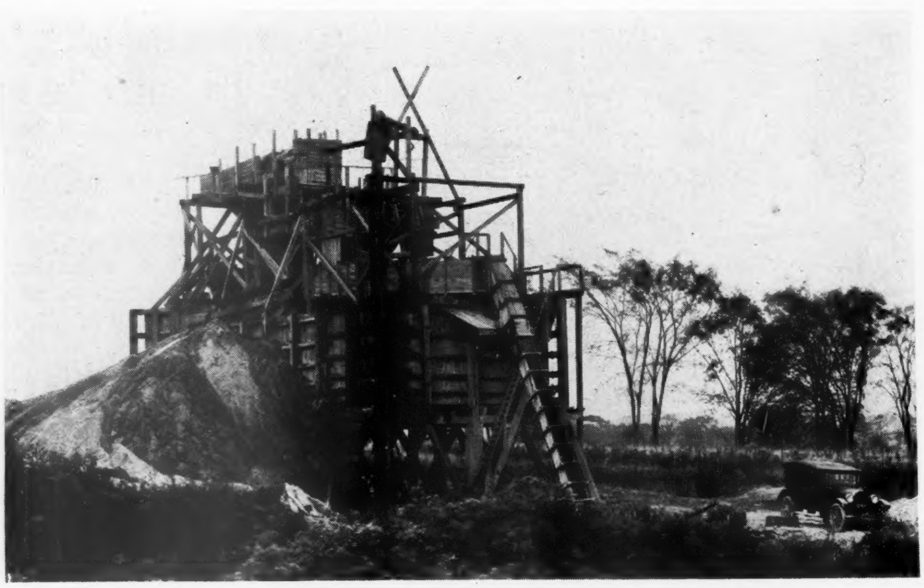
Unusual Operation of Dorwin Springs Sand and Stone Co., Syracuse, New York

THE Dorwin Springs Sand and Stone Co. of Syracuse, N. Y., conducts one of the few successful hydraulicking sand and gravel operations in the eastern states. Conditions at first sight would not appear to be especially favorable for this kind of an operation, as all the water used has to be pumped to the bank and the sluiced material and water then pumped to the screening plant, However, the choice of such method proved a good one, as the plant has been in successful operation for two seasons.

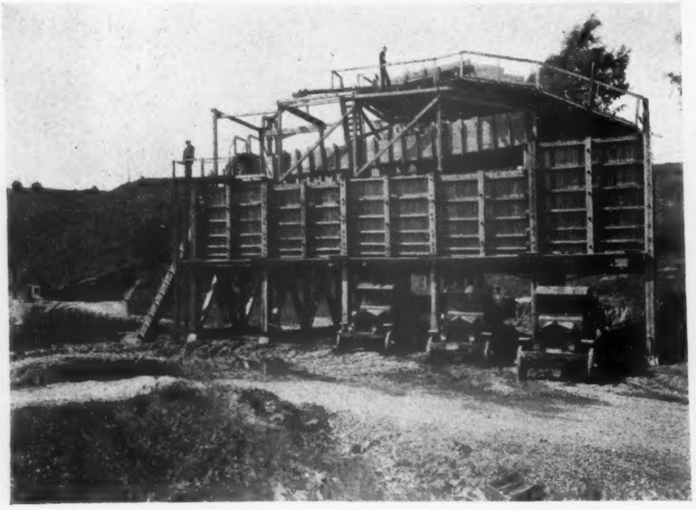
The location is just outside of the city limits of Syracuse, N. Y., at the foot of a ridge of glacial origin. The material composing this ridge or deposit is sharp, clean sand with a small percentage of gravel. The deposit is underlaid with a hard, impervious strata and ground water is encountered about 1 ft. above this impervious stratum. About 600 ft. from the plant there is located a fair sized creek of clear water, the water level in the creek being normally 2 or 3 ft. lower than the ground level at the foot of the deposit.

After a thorough study of these conditions and of the different types of equipment available, the management decided that the desired grades and quantity of material could be best produced by hydraulic methods. As the amount of water available from seepage would have been insufficient for the operation of a sand pump, it was decided to provide the necessary supply by pumping from the adjoining creek.

A convenient point was selected at the foot of the deposit and a sump hole was excavated with a clamshell bucket down to the impervious stratum. Water is pumped into this sump from the creek by means of a 10-in. centrifugal pump directly connected to a 40-hp. motor. At the sump there is a 3-in. centrifugal pump directly connected to a 20-hp. motor, which takes a portion of the water delivered by the pump at the creek and raises its pressure to about 40 lb. The high pressure discharge from this pump is used for washing down the sand from the bank into this sump. The resulting mixture of sand and water is pumped from the sump to the loading plant by means of an 8-in. dredging pump directly connected to a 150-hp. motor. The loading plant is about 400 ft. distant from the sump, and the material is delivered direct to the top of the screening plant at a point about 45 ft. above the water level in



The plant as now arranged with rotary screens for sizing gravel



Original plant with gravity screens

Pump house and face of bank

The piping system showing line from river with take-off for sluicing. The dredge pump is in house shown in lower left hand corner

the sump. The dredging pump suction is controlled from a small float in the sump.

Originally the plant was designed to receive the 8-in. dredge pump discharge on a flat gravity screen which would separate the small amount of gravel found in the deposit at that stage of its development. The undersize of this screen was then sent to two sand flumes over the plant bins. These flumes had gates in the bottom through which the sand was drawn out, while the water and dirt overflowed at the end of the flumes. The adjustable baffles in the flume and adjustable gates in the bottom permitted any grade of sand to be made.

This arrangement worked well so long as only a little gravel was found, all of which went into one product. But later the gravel became so large a part of the output that it was decided to put in sizing screens and at the same time to put in an additional type of sand-saving device. This was needed because the installation of revolving screens cut down the length available for the sand flume. So the present practice is as follows:

The material and water are delivered to the top of the loading plant and are first passed through a double jacketed revolving screen, which takes out the oversize and separates the gravel into two sizes. The sand and water then find their way through a Y flume into two automatic settling tanks, where the coarse sand is taken out and discharged directly into bins, while the fine sand and water find their way into two parallel sand settling flumes or boxes over the bins. In these bins, the sand is drawn off through the gates on the bottom of the flume. By adjusting baffle plates within the flume and by adjusting gates on the bottom, any grade of sand required can be obtained. By introducing screens over the top of the different compartments, any over sized particles can be excluded, and the sand obtained is both washed and screened. At the present time three grades of sand are being produced—concrete sand, in the automatic sand settling tanks, and brick sand and plaster sand in the flumes. The total capacity of the plant is approximately 100 tons of finished material per hour.

The plant as arranged, it will be noted, has several unusual features. There is first of all the method of sluicing and pumping, tapping into the main line to obtain water for the pressure jet. Next there is the use of a dredge pump delivering directly to a rotary screen and finally the combination of automatic settling tanks and sand flumes with both screens and baffle adjustments so as to give a wide range of sand products.

All the pumps, piping and fittings, were furnished by the Morris Machine Works of Baldwinsville, N. Y., and the plant was designed by Victor J. Milkowski, the engineer in charge of the dredge department of this company.

Officers of the company are Robert R. Molyneux, president; Mrs. Louise Rice, secretary; and Edward I. Rice, treasurer.

French Road Budget Has Large Increase

A REPORT from H. H. Kelley, U. S. Trade Commissioner at Paris, states that the 1927 French road budget shows a 40% increase over the appropriation for 1926. The 1927 road budget calls for 420,000,000 francs ($13,524,000) and Andre Tardieu, Minister of Public Works, says that even this increased amount will be inadequate for the needs of the French road system.

Two New Plants of the Birmingham Slag Company

Bessemer and Alice Furnace Operations Add 1500 Tons to Company's Daily Production

THE Birmingham Slag Co., of Birmingham, Ala., is the largest producer of crushed slag in the south and one of the largest producers in the United States. Its larger plants at Ensley, Ala., and Alabama City, Ala., have already been described in ROCK PRODUCTS.

The company probably ships its slag over a wider range than any producer of similar materials. Its crushed slag is used all over Florida and is marketed at many points in Georgia, Alabama, Louisiana and Mississippi. Good concrete aggregate and road building material is relatively scarce in these states. There is practically no crushed stone production except in the hilly portions of them. The flat, coastal plain country contains no deposits suitable for quarrying, with the exception of the Florida limestones and most of these are too soft except for use in road bases. Gravel is found in certain localities where it is worked for large tonnages, as at Montgomery, Ala., and other well known producing points, but the output by no means equals the demand. Hence in traveling through these states a car, or a pile, beside some new structure, of Birmingham slag is a very common sight.

Owing to the increased demand of the past year or two the company has built two new plants, one at Bessemer and one at Alice furnace, which have been producing steadily from the day they were started. Neither could be called a large plant from the standpoint of output, but both are interesting examples of good plant engineering. It is apparent that as much forethought went into the design and as good construction was used as though they had been built for much larger outputs.

A slag crushing plant has to conform more or less to the quantity of slag produced by the furnaces from which its supply is drawn and hence it is built no larger than is needed to crush this daily supply. At the Alice plant the capacity is for 500 tons per day and at the Bessemer plant, where there are more furnaces in operation the capacity is for 1000 tons per day.

Both plants have simple flow sheets with only one crusher. At the Bessemer plant the slag is dug from the cooling pit with a Marion No. 37 electric shovel and loaded into standard gage heavy steel gondola cars which hold 50 tons. These are brought in over a high line above the plant hopper by a standard locomotive which spots each car above the hopper in turn. The shovel loads other cars while these are being emptied at the plant hopper.

From the hopper everything goes to a 6-in. Allis-Chalmers gyratory crusher. The discharge of the crusher goes to a 20-in bucket and belt elevator with close connected buckets. The company makes these elevators, using a bucket which it has designed for use in the larger plants. The elevator discharge is split between two Allis-Chalmers screens of 48-in. diameter and 16 ft. length. A 50-hp. Allis-Chalmers motor drives all the machinery.

The screens make an oversize that goes back to the crusher and three finished sizes, 1½-in. to ¾-in., ¾-in. to ¼-in. and ¼-in. down, or screenings. Each of these goes to a bin beneath the screens which holds a little over a carload, three carloads in all. The bins are above the track and are provided with bottom gates for filling the contents into cars.

The Alice plant has been built since the Bessemer plant was built and the design and equipment are somewhat different. The whole practice is different, in fact. The slag is dug with a steam shovel and loaded into standard gage cars which are drawn to the plant by a steam locomotive.

The cars are dumped into a track hopper as in the Bessemer plant, but instead of the slag going directly to the crusher it

The 500 ton per day crushing plant at Alice furnace

New plant at Bessemer has 1000 ton per day capacity

Electric shovels digging slag from the cooler pits at the Bessemer and Alice Furnace plants

goes to a bucket and belt elevator which lifts it to a small hopper and feeding platform where a man stands to feed the crusher and to hook out any pieces of iron that may come in with the slag.

From the crusher, which is a 6-in. Allis-Chalmers, the discharge goes to a 16-in. bucket and belt elevator. This lifts it to two Link-Belt vibrating screens. Each of these has two decks or screening surfaces 5x3 ft. Only two finished products are made, 1¼-in to ¼-in. and screenings from ¼-in. down. The oversize of the screen is returned to the crusher through a chute and the finished product falls into the hopper-bottomed bins. Each of these holds a little over a carload.

Power is furnished by a 50-hp. Westinghouse motor. A 3-hp. motor drives the screens.

Both plants are built of steel throughout. The structure is high in relation to its other dimensions in both plants, but it is so solidly braced that there is very little vibration. The design of either might be adapted to a stone crushing plant producing only a few sizes.

Hoppers and motor drive at the Alice plant

Pushing a car into the track hopper over the crushers at the Bessemer plant

A "hot pot" train going from the furnaces to the cooling pits

Open Pit Quarrying Methods

By J. R. Thoenen
Consulting Engineer, Greenville, Ohio

As open pit quarrying is familiar to practically everyone, only a few of this class of plants will be described.

Plant No. 1

This is the type of plant commonly seen within the limits of densely populated cities and is simply an immense pit or hole in the underlying bedrock. This particular quarry consists of a city block cut to a depth of between 300 and 400 ft. The walls are practically vertical, but owing to the horizontal deposition of the stone itself they do not cave. There is of course no overburden to contend with after the surface soil has been removed.

Benches are carried 21 ft. high, using air piston drills mounted on tripods for initial blasting with hammer type drills for secondary shooting. Holes are drilled 21 ft. deep, spaced 7 ft., and carry 8-ft. burden.

Two kinds of rock are quarried. The bottom of the quarry is in a limestone unsuited for kiln rock and is worked for concrete aggregate. This rock is hoisted through an open steel shaft anchored to the side of the pit direct to the crushing plant built over concrete storage bins.

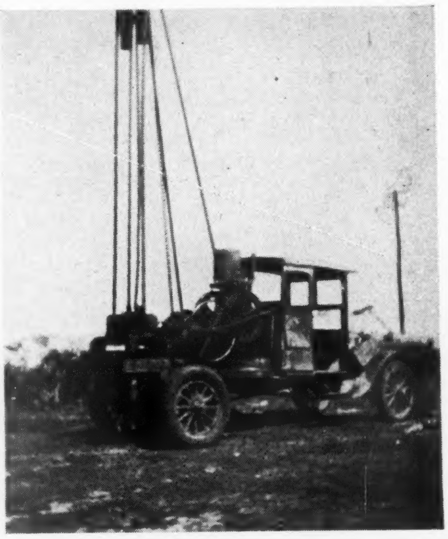
An upper bench not yet wholly consumed furnishes kiln rock to several kilns also located on the surface. This rock is loaded into steel boxes set on trucks. A derrick on the surface picks these boxes up and sets them on other trucks on a level with the tops of the kilns, from where they are trammed direct to the kilns by hand. All loading and tramming is done by hand; 13.4 tons of rock are produced per man in quarry; 4.4 tons of rock are produced per foot of drill hole.

Plant No. 2

At this plant a bench of limestone is quarried 32 ft. thick. The overburden consists of clay and loam from 15 to 100 ft. thick and is removed by tractor type steam shovels loading into side-dump cars hauled by gasoline locomotives.

Upon removal of overburden the limestone is drilled by air hammer type drills mounted on an ingenious derrick which allows an 8-ft. run on each steel instead of the usual 30 in. Holes are drilled 28 ft. deep, spaced 6 ft., and carry 6 ft. of burden. Rows are staggered.

After the hole is started with a short bit the drill is hoisted up the derrick and a long steel used. The weight of the drill is thus constantly on the steel and keeps the cutting edges on the bottom all the time. As the bit cuts the drill gradually descends the guide on the derrick until a longer steel is required, when the drill is hoisted and the process repeated. Thus only three or four bits are required for a 28-ft. hole instead of the 14 or more necessary by the usual tripod mounting. The limestone being comparatively soft, the bit gage is not lost as it would be in harder ground for this length of run. Derricks are light and two men easily handle them, drilling an average of 140 ft. daily. Holes are drilled dry and cuttings removed by compressed air through the steel. Round hollow lugged steel 1⅛-in. diam. with a flat bull bit is used.



Air hammer drills mounted on derrick; this allows an 8-ft. run on each steel and cuts down bits used

Loading is done by tractor and caterpillar type air and electric shovels into 17-ton steel cars hauled by gasoline and electric locomotives to a rotary dump over the crusher.

Three and one-tenth tons of rock are produced per foot of drill hole; 3.5 tons of rock are produced per pound of explosive.

Plant No. 3

At this plant the stone ledge is 21 ft. thick, underlying from 10 to 60 ft. of hard shale and dirt. The overburden is drilled by gasoline driven well drills, placing holes 30 ft. apart and 25 ft. back of the face. These holes are shot with black powder when dry and with gelatine dynamite when wet.

After breaking, the shale is removed by 2½-yd. railway type steam shovels loading into 4-yd. side-dump cars hauled by 18-ton steam locomotives.

Hammer type air drills then are used to drill the limestone bench; the drills are mounted on tripods drilling 20-ft. holes 4 ft. apart and with 4-ft. burden.

The limestone ledge consists of a 3-ft. stratum of hard grey stone on top with a softer blue stone below. This necessitates blasting with separated charges, using two exploders in each hole. Twelve sticks of 40% gelatine dynamite are loaded in the bottom of the holes, followed by 5 ft. of dirt tamping on which 3 sticks of 60% gelatine dynamite are charged and the hole tamped to the top. Firing is done with electricity at 220 volts.

One and one-quarter-in. hollow round lugged steel is used with 4-point bits on starters and seconds and 6-point bits on the balance.

The stone is loaded with 2½-yd. railway type steam shovels to 5-ton side-dump cars hauled by 18-ton steam locomotives.

Working ten hours, 28.5 tons of limestone are produced per man in quarry and 48 yd. of dirt and shale per man on stripping; 1½ tons limestone are produced per foot of drilling; 4.3 tons limestone are produced per pound of explosive.

Plant No. 4

This plant is an open pit with from 1 to 12 ft. of overburden removed by 1¼-yd. caterpillar type steam shovel loading 16-cu. yd. standard gage side-dump cars hauled by 30-ton steam locomotives.

The limestone is carried in two 40-ft. benches. Drilling is done by electrically operated well drills using 5⅝-in. holes 42 ft. deep, spaced 10 ft., and with 12 ft. of burden.

The broken limestone is loaded by 3½-yd. steam shovels to 6-yd. side-dump cars hauled by 20-ton steam locomotives.

Eighteen tons are produced per man in quarry; 9.2 tons are produced per foot of drill hole; 2 tons are produced per pound of explosive.

Plant No. 5

Overburden at this plant is negligible, consisting of from nothing to 3 ft. of dirt removed by hand shovelers and auto trucks.

The limestone is carried in one 50-ft. bench, drilled by electrically operated well drills spacing 5⅝-in. holes 10 ft. apart with 15-ft. burden.

Loading is done by hand to 2½-ton cars hauled by horse to foot of incline, from where an electric hoist brings it to the crusher.

Fifteen tons are produced per man in quarry; 11.5 tons are produced per foot of drill hole; 2.3 tons are produced per pound of explosive.

Based on 100% for total cost per ton of stone, costs are as follows:

Stripping	2%
Explosives	11%
Labor	40%
Supplies	10%
Fuel	5%
Depreciation	4%
General expense	28%
	100%

Advanced Methods of Washing Limestone

Camp Concrete Rock Co. by Adapting Ideas from Phosphate Rock Practice Produces Very Clean Aggregate from the Tampa Limestone

THE plant of the Camp Concrete Rock Co. is five miles from Brooksville, Fla., and it works one of the best deposits that has been opened in the Tampa limestone formation. In this formation the limestone occurs in boulders and larger masses in a clay "matrix." In some places in this field the limestone forms a higher percentage of the whole deposit than in others and at this quarry the percentage is said to be unusually high.

The quarry was opened in August, 1925, and the pictures, which were taken in February, 1926, show the plant completed and running and the quarry developed to produce all that is needed for the plant. The speed with which the work has been done is remarkable, even for Florida.

However, the owners of the plant have been engaged in the rock products industries all their lives and have built a number of plants, especially for mining and washing hard rock phosphate, so all the problems which the new plant presented to them in the way of excavating, washing and crushing were familiar, and their experience had been in Florida, where conditions are somewhat different from in other parts of the country.

The ground is heavily wooded with pine trees and these have to be removed as the first step. Next the top soil is stripped with a 30-B Bucyrus electric dragline for a depth of about 3 ft. The strippings are loaded into Koppel 2-yd. cars and hauled away to a dump by a 7-ton Plymouth gasoline locomotive. Afterwards the ground is drilled by a Keystone drill to a depth of 35 ft., which is 5 ft. below the quarry floor. The holes are loaded with both black powder and dynamite, the dynamite being placed at the top and the bottom of the holes.

The broken rock and the clayey material which accompanies it are loaded into end dump cars with a round body of a type which was first introduced in the phosphate field. They are made of old boilers, where these are obtainable of the proper size, and this type is so much liked that they are regularly made by a local foundry and machine shop in Ocala.

Two Bucyrus shovels are used for loading cars, one is a 50-B steam shovel and the other a 30-B, electric. The cars are drawn up two separate double track inclines leading to the plant and there dumped over a grizzly of rails set 8 in. apart. The hoist is of a type which is not so familiar in other sections as in Florida. It is very simply made with a pair of drums and clutches and post brakes mounted on a single shaft. It was made by the Ocala Iron Works, of Ocala, Fla. The rope that pulls the car passes to a sheave above the grizzly and then over an angle sheave below to bring the rope straight into the drum. The operator stands on a

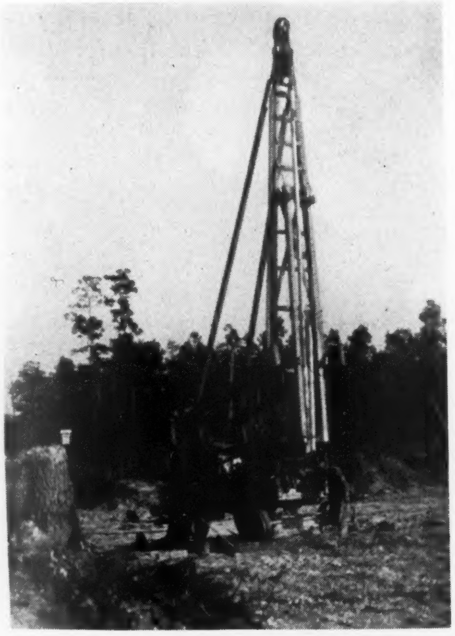
Looking down into the quarry from one side of the plant incline, Camp Concrete Rock Co.

Dragline stripping above the qaurry and cars for carrying strippings away

platform high enough so that he can look over the grizzly and down the incline into the quarry, the controls of the hoist being brought to the platform by long links and levers. The hoist is driven from the main plant motor through a belt which has a tightening pulley. The platforms, of which there are two, one situated above the other at the top of the plant are each manned by individual operators who control the cars on the separate tracks.

The grizzly is 20 ft. wide at the end where the car dumps and narrows down to 5 ft. at the lower end so that the sides of the grizzly turn all the oversize into the primary crusher. This is a single roll crusher, 24x60 in., of Allis-Chalmers make. The undersize of the grizzly and the discharge of the crusher are joined in a chute under the crusher that leads to the scalping screen. This is 12 ft. long and 60 in. in diameter and it is perforated with 4-in. round holes. The oversize of the screen is crushed in a 24x48-in. single roll of the same type as the primary roll crusher.

The undersize of the screen and the discharge of the crusher are flushed with water to two double logs or log washers made by the McLanahan-Stone Machinery Co. These are 25 ft. long and of an unusually heavy design. The overflow of these logs is clay and some "sand," that is material finer than ⅛-in. At present this is sent to waste, but it is expected that it will be recovered in the near future. The scouring action of the logs is very effective in breaking up clay balls and washing the clay from the surfaces of the rocks.

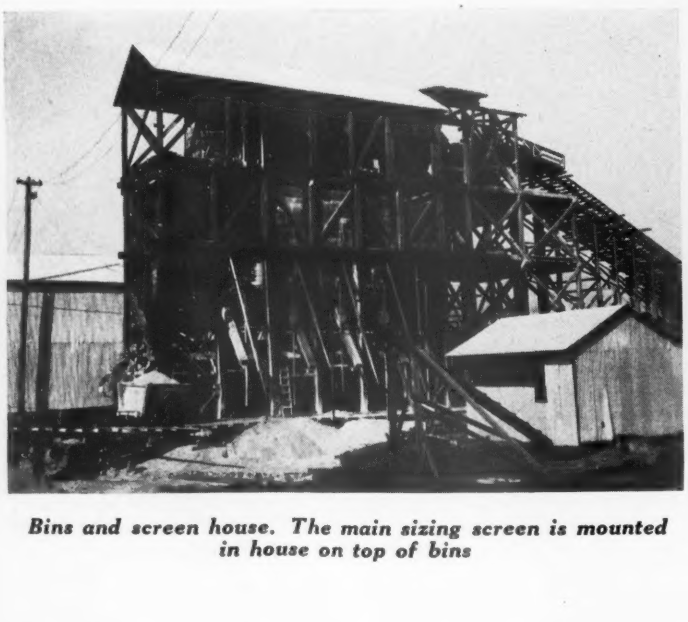


Drill working in stripped ground

The undersize of the logs go to two screens, each of which is 20 ft. long and 36 in. in diameter. These screens have two jackets the full length of the screens. The inner jacket has 1-in. by ¼-in. slots. The undersize of this screen is sent to waste. There are heavy sprays in this screen to rinse off the clayey water from the logs and to carry off the fine material. The size between the two jackets is a finished product and goes to bins.

The oversize of this screen, now thoroughly washed and rinsed, goes by a horizontal conveyor to a "Cataract" grizzly made by the Robins Conveying Belt Co. This is set to make a ¾-in. undersize product. This undersize is a finished product and is sent by conveyor and elevator to the bins. The oversize goes to a pair of 48x20-in. Allis-Chalmers rolls.

The product of these rolls goes to a sand screen similar to that which screens the product of the log washers. This makes one finished product, between the two jackets, a waste product and an oversize product which is elevated to the main sizing screen.



Bins and screen house. The main sizing screen is mounted in house on top of bins

Hoist house for storage system. Note the braced frame that supports the sheave

This main sizing screen, of Allis-Chalmers make, is 24 ft. long and 72 in. in diameter. The sections are perforated with ¼-in., ½-in., ¾-in. and 1¾-in. holes. The oversize of the screen goes to the ballast bin. The other sizes go to bins provided for them. All these bins are in a block about 20 ft. wide and 60 ft. long. The main sizing screen is mounted on top of the bins and covered over by a roof.

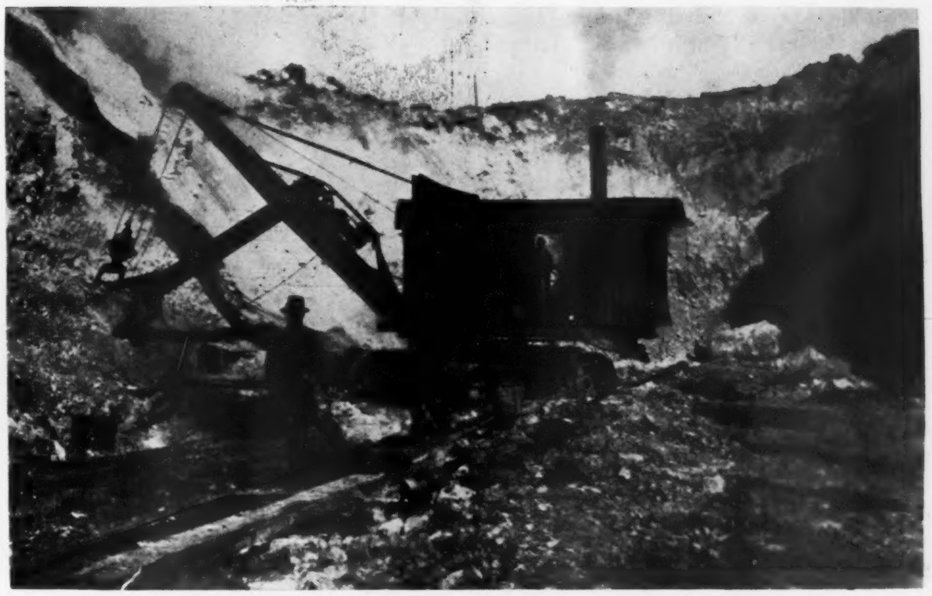
The bins are discharged through gates in the hoppered bottom, which allow the material to run on to a conveyor belt. The discharge of this belt is to an inclined chute with a heavy screen bottom. Sprays play on the material as it passes through the chute and give it a final rinsing as it is run into cars.

This plant has an excellent storage system. A track runs under the bins and extends in both directions to trestles. Fine material is built into a storage pile on one side and coarse material on the other.

The car which takes the material to storage has side doors which are automatically unlatched as the car reaches the proper point on the trestle. The car is pulled by a friction hoist of the same type used to pull the cars from the quarry to the plant. There are two drums and the ropes from each pass out of the hoist house in opposite directions. They pass over a sheave supported on a braced frame and on to the end of the trestle, where they pass over another sheave and return to the car. The car runs back by gravity. From the stockpile the material is loaded into cars by a crane.

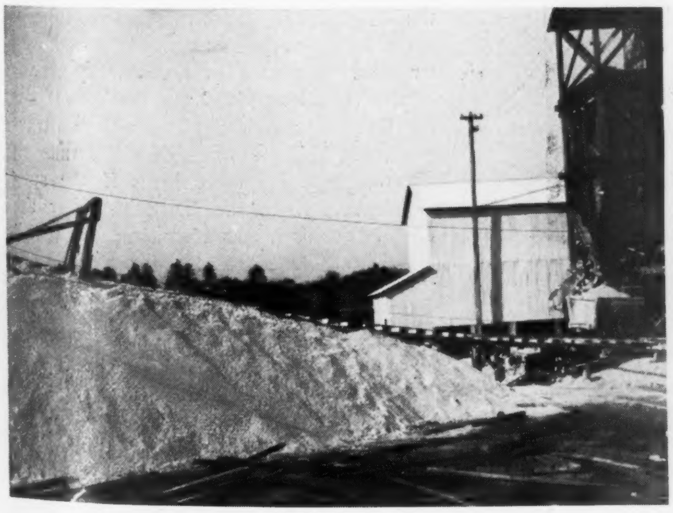
Water for washing is obtained from a well which is 60 ft. deep and about 40 ft. long and 24 ft. wide. It is covered by a house and the sides are timbered and lagged to prevent dirt falling in. Two 10-in. Delaval centrifugal pumps are installed at the bottom of this well and 3000 g.p.m. are sent to the plant to be used in the log-washer and in the screens. All of the screens are provided with sprays except the final screen above the bins.

The material is very clean but it is made so only by careful attention to the washing,

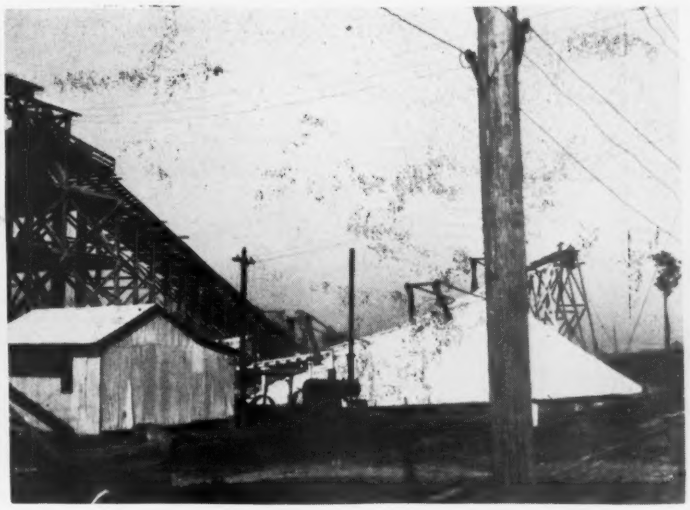


Shovel loading cars in quarry. The limestone is in boulders in a white clayey matrix

Ends of log washers in washing plant



Storage pile for larger sizes of stone



Storage pile for fine material

as the clay that is washed off is very sticky. It feels like paste when it is rubbed between the thumb and finger.

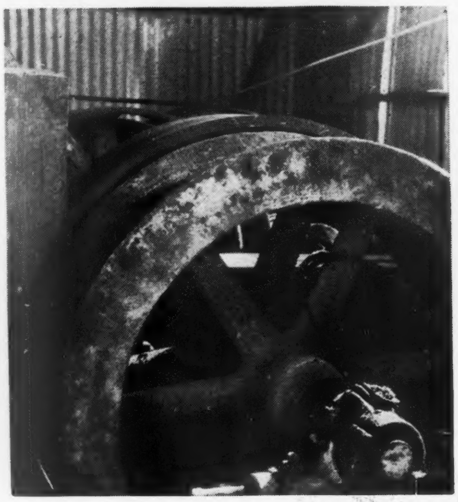
The design of the plant is excellent, not only as regards the washing but the crushing. The crushing is in steps with the removal of the fines after each break so as to avoid overcrushing and the making of fines, which would be carried away in the wash water.

The product of the plant is sold over practically the whole of Florida and the demand for good concrete aggregate has been so brisk that the production is shipped as fast as it can be made. The shipping point is at Camp, Fla., on the Atlantic Coast Line railroad.

The entire plant is electrically driven, General Electric and Westinghouse motors being used. The largest motor is of 150 h.p. and this drives one of the single roll crushers, two of the sand screens and the friction hoist that brings the rock from the quarry to the plant. Jeffrey conveyors and elevators are used throughout the plant.

The office of the company is near the plant. Owing to the distance from any town the company has to maintain a commissary and houses for the men.

The officers of the company are: Jack Camp, president; E. F. Fitch, vice president; Clarence Camp, secretary and treasurer; J. T. Rawls, general superintendent; D. L. Ghiotto, plant superintendent, and C. W. Stone, sales manager.



Hoist used for the quarry incline for the storage syste mat the Camp Concrete Rock Co.

Looks for a Forced Building Boom in 1927

ALLEN E. BEALS, who writes the *Dow Daily Building Reports,* predicts an artificially stimulated building boom in 1927. He says in part in the issue of November 6:

"Investment interests are beginning to read out of this week's election returns the promise of a brief stimulation of building—with penalties.

"They believe that building, as an industry, is going to be swung out of its recent national decline into an approximate one-year boom, but that there will be an economic price to pay for thus violating the laws of supply and demand.

"Building material mills are being geared for big production. The word has gone forth from sales managers to salesmen to make 1927 another boom year. Mill orders are being placed on that basis by jobbers and distributors throughout the industry now, hence the increase recently noted in national industrial building expansion.

"Architects are getting busy again and contractors are getting better prices for next year's work, according to the Department of Labor, which says that 'in 1919 material cost on a building operation was 54.8% and labor 45.2%. Two years later the situation was reversed. Labor costs then were 58.1% and material was 41.9%. In 1924, material was 40.5% and labor 59.5%. Last year, according to the same authority, material costs were 39.8% and labor cost 60.2% of a building operation.'

"Bradstreet's for November 1, 1926, shows that building material prices have turned from their recent downward course and during the month of October have reverted to the level of November, 1925, which was considered high. Last month's gain alone was five points in basic building material prices.

"Another reason given by building investors for their growing belief that the national construction industry is headed for another brief speculative rodeo is that it is the custom of people to buy when prices rise. When there is a falling building material price market people wait to see how far it is going to fall. On a rising market they first satisfy themselves that there is sound basis for the rise, and then they come in to buy before the price goes higher.

"There is no present national requirement for another boom building year. Building construction was shown by a Labor Department survey in August, 1925, to have caught up with housing needs. Ethelbert Stewart, Commission of Labor Statistics, who conducted the survey, said at the time that at the close of 1924 building in the United States had gone ahead of demand for the first time since the war, adding, 'Construction needs now meet only normal requirements and a continuation of the high rate of building as in the last few years (1921, 1922 and 1923) might result in overproduction, with a sequel of depression.'

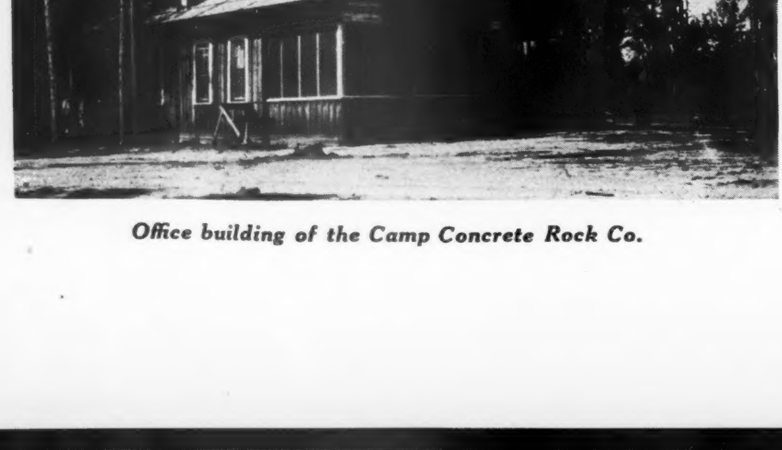
"In December of 1925 the real estate committee of the Investment Bankers' Association of American reported that the national building peak had been reached. It showed in its report that rents were then stationary or were turning downward, adding that it had incidently found that building costs were then 92% above prewar costs and 10% higher than living costs.

"In the July, 1926, issue of the Department of Labor's monthly labor review the announcement is made that during 1925 there had developed a surplus of building over normal needs of the country totaling 11.2% as compared with 1924.

"There is only one analogous precedent in this country upon which to gauge postwar building construction expectancy. That concerns the reconstruction period following the Civil War. It then required thirteen years for building material prices and construction to return to normal, or prewar levels. Counting 1920 as the peak year for building material prices and construction costs, 1927 will complete the permanent turning point for these items if the span of recovery is to be the same after the World War as it was after the Civil War."

"Cement in 1924"

DETAILED statistical information in regard to the operations of the cement industry are contained in Bureau of Mines publication "Cement in 1924," by E. F. Burchard and B. W. Bagley, copies of which may be obtained from the Superintendent of Documents, Washington, D. C., at a price of 5 cents.



Office building of the Camp Concrete Rock Co.

Some Suggestions on the Manufacture of Cement*

Study of Calcination—Comparative Methods of Chemical Analysis — Improving the Aptitude of Calcination —Effects of Grinding Mediums of Strength of Cement

By R. E. Dupuis
Engineer, Orp. le Grand, Belgium

THE launching on the market of special cements, called alumina, electric and fused cements, has introduced the public to cement of exceptional qualities and has caused it to raise its requirements and to expect from ordinary cements such superior qualities as rapid hardening and high initial and final strength. Numerous extensive studies were made in this connection by cement manufacturers. Their purpose was to intensify the phenomena of setting and hardening and to increase the activity, as well as the rate of reaction of cement.

The different constituents of cement are in a state of latent instability, i.e., their molecular equilibrium is upset in contact with water. The reaction thus produced takes place at a rate depending upon the reacting substances and the surrounding medium. In portland cement this rate of reaction is influenced by two factors: The presence of gypsum and calcium chloride, added to the clinker, and the degree of fineness. Water reacts immediately only with the surface of the cement particles, further reaction being gradual, not instantaneous. Greater fineness of particles increases the reacting surface at the time of mixing and accelerates the phenomena of hydration producing a more rapid set. The latter stands in direct relation to the fineness of cement. Gypsum and calcium chloride when present in weak solutions, retard the hydration of aluminates, as they retard their solution and, consequently, reduce the formation of calcium sulfoaluminate, i.e., retard setting. The calcium silicate assumed to be $3CaO \cdot SiO_2$ reacts with water producing hydrated monocalcium silicate and hydrated lime. This lime, when liberated forms supersaturated solutions and, subsequently, crystallizes into very long crystals of $Ca(OH)_2$. The rate of this reaction is proportional to the molecular concentration of the reacting substances, but it is also determined by the rate of crystallization of lime. A compound such as calcium chloride in weak solution, which diminishes the solution of lime liberated through hydration, reduces the rate of the reaction:

$$3CaO \cdot SiO_2 + Aq = CaO \cdot SiO_2 \cdot Aq + 2Ca(OH)_2$$

R. E. Dupuis

R. E. Dupuis, the author of this interesting study of cement, is a graduate engineer from one of the finest European universities. Through his research work on "liant hydraulique" (hydraulic limes) and which has covered a long period, he has established for himself a reputation among European cement technicians.

This is the reaction which determines hardening of the product. Increased concentration of water reducing crystallization of lime, will reduce the rate of hardening. This rate depends on the rate of hydration, while the strength obtained stands in direct relation to the quantity of $Ca(OH)_2$ which crystallizes.

Our efforts should thus be directed towards raising the concentration of silicates rendering them more apt to react with water. Ground cement is a conglomeration of individual particles, at whose surface the reaction begins. It is necessary to increase the reacting area of cement by producing maximum surface development, i.e., reducing the diameter of particles. A particle of radius $r=1$ has a volume $\frac{4 \cdot 3.14 \cdot 1^3}{3} = 4.19\ v$ (where v is the unit of volume) and a surface area $4 \cdot 3.14 \cdot 1^2 = 12.56\ s$ (where s is the unit of surface). If we reduce the diameter of the particle to $r = \frac{r}{2} = \frac{1}{2}$, the volume becomes $\frac{4 \cdot 3.14 \cdot 1^3}{3 \cdot 2^3} = 0.52\ v$. The surface becomes $\frac{4 \cdot 3.14 \cdot 1^2}{2} = 3.14\ s$. The first particle contains $\frac{12.56}{3.14} = 8$ secondary particles whose total area is $3.14 \cdot 8 = 24.56\ s$ or twice that of the original particle. This computation shows us the importance of fine grinding of clinker. This subject will be discussed more in detail later.

Coming back to the reaction $3CaO \cdot SiO_2 + Aq = CaO \cdot SiO_2 Aq + 2Ca(OH)_2$ we see that the lime which is liberated, after being dissolved in water and having formed a supersaturated solution, must be eliminated in order to permit the reacting of new calcium silicates and complete the reaction. The lime thus crystallizes and the crystals, filling the voids in the mortar impart strength to the product. We have thus been led to produce cements liberating large quantities of $Ca(OH)_2$ and yielding high strengths. We have, in fact, produced perfectly stable cements whose lime content greatly exceeded that computed on the basis of the compounds $3CaO \cdot SiO_2$, $3CaO \cdot Al_2O_3$, $3CaO \cdot Fe_2O_3$, thus confirming our hypothesis that the formation of the lime silicate in cement is due to a solid solution of lime in bicalcium silicate. The calcination of cement with such high lime content is extremely difficult and requires special skill for it is of great importance to produce stable products, containing but small amounts of free lime, which, aside from producing swelling of the mass, retard the hardening of the product. Forced to work with high proportions of carbonates we have sought means for facilitating their calcination, which will be discussed below.

Study of Calcination

Samples were collected for each meter of length of a rotary kiln, 2 m. in diameter and 30 m. long, stopped accidently while operating at full speed. A special study was made of the samples taken at 0, 5, 10, 15, 17, 19, 20, 21, 22, 23, 24, 25, 26 m. from the charge openings of the kiln. The samples were designated by reference numbers corresponding to the locations just mentioned.

The zone of clinkerization proper is situated between 23 and 26 m. The rock, of a dirty grey at the charge opening, changes color, becomes lighter and assumes a yellowish coloring at 17. At this point, the material consists of small round particles whose diameter varies from 8 to 12 mm. These lumps, markedly yellow and very friable, when crushed between the fingers, form a sandy powder which is more uneven

*Translated from the French by M. A. Corbin, Riverside, Ill.

and of a deeper color than the sample itself. At 20, these lumps become very hard. At 21, one is rarely encountered which can be crushed between the fingers. The color becomes deeper and appears brownish. When broken, the lumps still present a brownish sandy appearance, but interspersed with small block dots. At 22, the appearance is that of underburned lumps. At 23, apparently burned clinker of a very light color is encountered; the density of particles increases further, until at 26 we find a standard clinker whose calcination is completed.

Loss on Ignition

The loss on ignitions was determined for samples calcined in closed platinum crucible

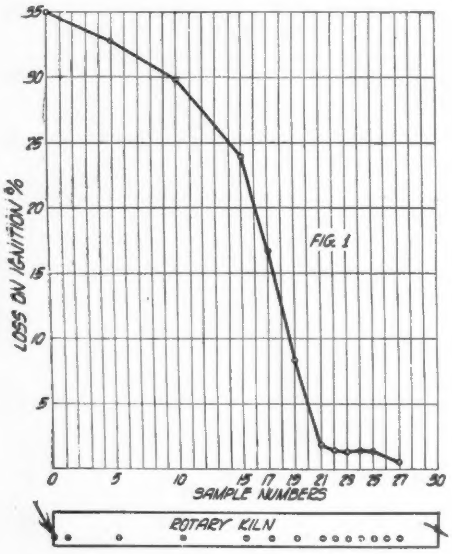


Fig. 1—Ignition losses of samples drawn from different points in rotary kiln

to a constant weight. The results given below are plotted in Fig. 1.

TABLE I.

Ref. No. of sample	Loss on ignition
0	35.00
5	32.83
10	29.80
15	23.98
17	16.72
19	8.36
21	1.82
22	1.38
23	1.30
24	1.40
25	1.30
26	0.56

Insoluble Residue—Acetic Acid Determination—Index of Refractiveness

The physical tests of samples seem to show that a decomposition of argillaceous constituents takes place by the action of the liberated lime even in the zone of the kiln in which decarbonation is going on. Wishing to reduce this action to figures, we have studied the relative solubility of samples and have thus determined the per cent of matter remaining refractory. We have chosen acetic acid as a solvent due to relatively low solubility of silica in this acid, for we were trying to avoid too strong a reaction. We proceeded as follows: One gram of the sample, finely pulverized in an agate mortar until it left no residue on the 180x180 sieve

TABLE II.

Ref. No. of sample	Insoluble residue	Loss on ignition	% dry matter	Insoluble residue % dry matter	Insoluble residue computed per 1 gm. entering the kiln
0		35.00	65.00		
5	16.86	32.83	67.17	25.10	16.31
10	13.96	29.80	70.20	19.88	12.92
15	11.30	23.98	76.02	14.87	9.66
17	10.52	16.72	83.28	12.75	8.28
19	6.62	8.36	91.64	7.22	4.69
21	0.53	1.82	98.18	0.54	0.35
22	0.47	1.38	98.62	0.48	0.31
23	0.11	1.30	98.70	0.11	0.07
24	0.10	1.40	98.60	0.10	0.06
25	0.10	1.30	98.70	0.10	0.06

was allowed to digest for 30 minutes in a steam bath with 30 c.c. of 80% acetic acid. It was then brought to boiling for a few moments. A few c.c. of hot water were added and the pink coloring eliminated by adding drop by drop diluted nitric acid. The sample was brought to the boiling point for a few moments, filtered by decantation and the insoluble residue collected in water acidified with nitric acid. It was boiled, filtered, washed thoroughly with boiling distilled water, then with 250 c.c. of a boiling 10% solution of sodium carbonate, then with water, slightly acidified water and finally with water until a drop of filtrate evaporated on a platinum foil left no trace. The sample was dried, calcined and weighed. The results obtained by this method are given in column 2 of Table II; column 6 gives the insoluble residue computed for one gram of matter entering the kiln.

A study of Fig. 2 shows that considerable decomposition takes place in the relatively cold zones of the kiln. We attempted to synthesize this decomposition by calcining a sample of matter in a closed platinum crucible, using as the source of heat a Barthel burner No. 2 and petrol of a density $d=\frac{15}{4}=0.680$ as fuel.

A 1-gram sample after ½ hr. of decomposition under these conditions gives a residue of 0.0984 or 9.84%, determined by the acetic acid method described above. The effect of calcination made the sample approach that of 15. Heating the 1 gram sample for 1 hr. we obtained 9.61% insoluble residue.

We tried to reproduce conditions at 17. This time a ½ gram sample was taken, as 1 gram proved to be too thick. Calcining the ½ gram sample for ½ hr. we obtained only 7.88% insoluble residue. Continued heating for 5 hr. resulted in an insoluble residue of 7.45% for 10 hr.—of 7.36% in the acetic acid and sodium carbonate.

The slight variation of our results permitted us to conclude that heating a ½ gram sample for half an hour was a sufficiently representative test of decomposition. To make our results comparable we introduced a formula determining the *index of refractiveness:*

$$I=\frac{R\cdot 21}{AI}$$

where I is the index of refractiveness

R—the insoluble residue of a ½ gram sample calcined for ½ hr. and subjected to the attack of acetic acid and sodium carbonate

AI (clay)—is the content of $SiO_2+Al_2O_3+Fe_2O_3$ in the sample obtained in a rapid method described below.

21 being a coefficient for comparison which represents a compound of constant type containing 21% of the above compounds.

In the present case the index of refractiveness $I=\frac{7.88\cdot 21}{21.54}=7.682.$

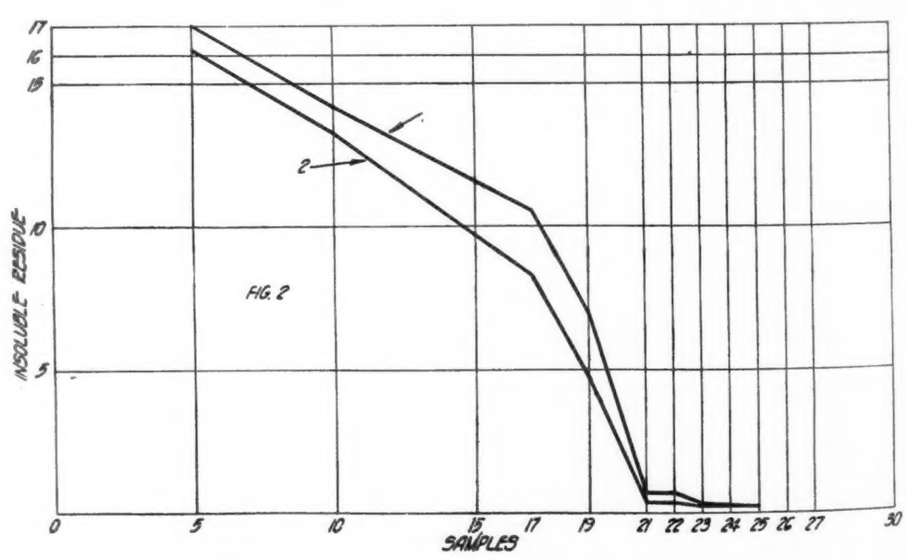


Fig. 2—Residue insoluble in acetic acid—curve 1 represents the insoluble as found by analysis and curve 2, the residue computed per gram of slurry entering the kiln

The following method is used in determining the clay (AI) of a sample:

Weigh 1 gram of sample, dried and finely pulverized in an agate mortar, and place it into a beaker or a porcelain evaporating dish with 90 c.c. distilled water. Add drop by drop, avoiding spattering and formation of lumps, 10 c.c. hydrochloric acid, 22 deg. Baumé. Let react for 5 min., add a few drops of bromine water, and boil gently for 3 min. to eliminate carbonic acid and oxidize the ferrous salts. Remove from fire, rinse the lid and the sides of a vessel, add litmus paper washed thoroughly, and precipitate by means of ammonia until the litmus turns blue. Boil to drive off the excess ammonia, stopping when the vapors are free from ammonia. Filter through a fluted filter, wash with boiling water until the washings are free from chlorides. Dry, calcine gradually the gelatinous precipitate, inclining the crucible to avoid reduction of iron and weigh. We make use of an excess of acid to produce a more complete reaction and a more rapid and more complete liberation of CO_2; also in order to obtain at the time of the precipitation by ammonia the formation of ammonium chloride which prevents the formation of magnesium hydroxide. Avoid excess of ammonia which might dissolve the alumina and precipitate magnesium hydroxide in accordance with the equation:

$$MgCl_2+NH_4OH \leftrightharpoons 2NH_4Cl+Mg(OH)_2$$

which is a chemical equilibrium. The ammonium chloride, thus formed, tends to complete the reaction from right to left. If no excess NH_4OH is present, magnesium hydroxide in the precipitate need not be feared. The precipitate must be thoroughly washed as it may carry off $CaCl_2$, $MgCl_2$ and NH_4Cl which may become liberated during calcination and, in turn, carry off some of the precipitate. In all cases, a considerable excess of NH_4Cl before precipitation confuses the results, making them appear too high. The ammonia must always be fresh and free from CO_2. It is important to eliminate excess ammonia, the precipitation taking place at pH7. Weigh: $SiO_2+Al_2O_3+Fe_2O_3$ which we designate collectively as *Argile Industrielle* or clay.

Returning to the index of refractiveness, we note that in order to facilitate the reactions of clinker formation and to make them more complete, to make the operating of a rotary kiln a less tiresome job, to obtain a product richer in lime with the same amount of work of the kiln, without lowering its output nor decreasing the life of its lining, we have to reduce the index of refractiveness. Our attempts in this direction are described below. We may state here, that since the publication of Hendricks' work, we have abandoned acetic acid as a reagent together with our formula in an effort to standardize the procedure and avoid unnecessary complications in analyzing cement.

The values in Table II show undeniably that the reactions take place gradually and that decomposition of acid constituents occurs over the entire length of the kiln, as a result of free lime liberated in the decarbonation of the carbonates. Decarbonation and solution of the argillaceous elements are simultaneous reactions. It appeared equally interesting to determine quantitatively the free lime encountered in the different sections of the kiln. This was done making use of the Leduc method of sugar solution.

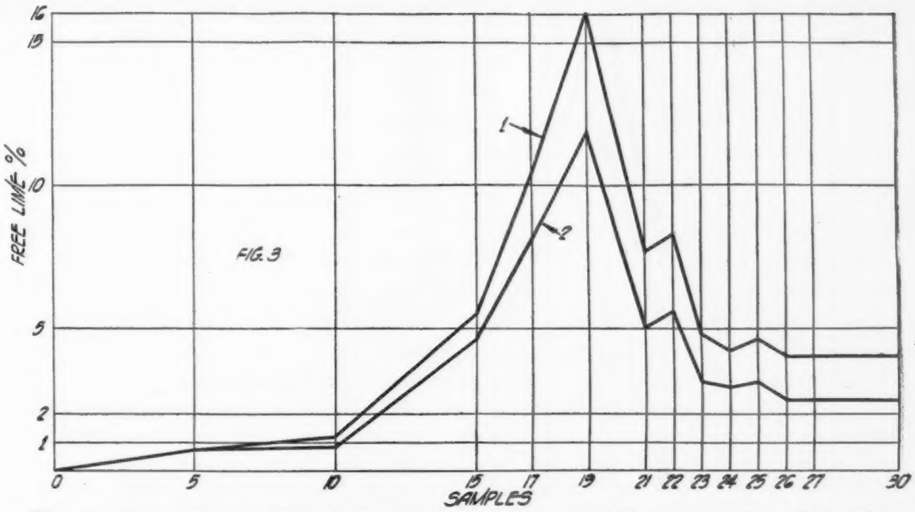


Fig. 3—Free lime produced during calcination at different points along the kiln— curve 1 represents free lime as found by analysis and curve 2, the free lime computed per gram of slurry entering the kiln

Free Lime

Shake 1 gram of sample, dried and pulverized as above, during 15 min. with 100 c.c. of a 10% sugar solution (sucrose). After filtering through a pleated filter, titrate the filtrate containing free lime with H_2SO_4. The results are given below in Table III.

TABLE III.

Reference No. of sample	Free Lime	Free lime computed per 1 gm. of matter entering the kiln
5	0.6944	0.669
10	1.0416	0.962
15	5.3816	4.600
17	10.2424	7.833
19	15.9712	11.388
21	7.6384	5.038
22	8.3328	5.492
23	4.6872	3.088
24	4.1664	2.743
25	4.5136	2.971
26	3.8192	2.496
27	3.8192	2.496

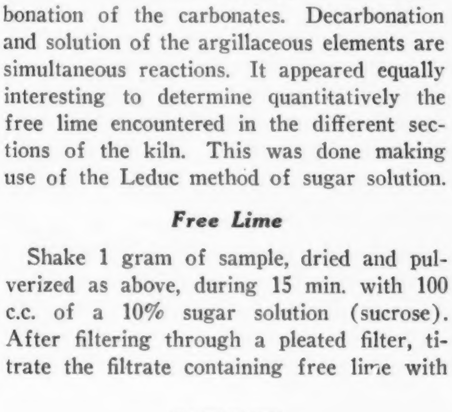


Fig. 4—Residue insoluble in hydrochloric acid — curve 1 is the insoluble determined by analysis and curve 2, the insoluble per gram of slurry entering the kiln

These two series of tests, index of refractiveness and free lime, have given rise to conclusions which will be discussed below. However, in spite of the results obtained and the advantages of the acetic acid method, we have replaced it by the hydrochloric acid determination used by Hendrick wishing to make our results comparable with his work. We have also abandoned our index of refractiveness making use of his formula for "aptitude to calcination."

Insoluble Residue—Hydrochloric Acid Determination—Aptitude to Calcination

Weigh a 1-gram sample, finely pulverized as above, add water, then 10 c.c. of hydrochloric acid, 22 deg. Baumé. Avoid spattering. When the reaction seems complete, reduce to 100 c.c. after crushing the lumps which may form. Let react cold for 5 min.; boil 3 min. Remove from fire, allow to settle; decant on ashless filter. Add 20 c.c. of water and ½ c.c. concentrated hydrochloric acid and boil a few moments. Filter, wash by decantation with boiling water. Place in 100 c.c. of 10% sodium carbonate, and boil 5 min. Decant on the filter, while boiling, mix with 10 c.c. of 10% sodium carbonate, boil, filter, collect the residue, wash successively with boiling distilled water, water acidified with hydrochloric acid and finally with distilled water until the washings are free from chlorides. Dry, calcine and weigh

TABLE IV

Reference No. of sample	Insoluble residue	Insoluble residue computed for 1 gm. of matter entering the kiln
0	14.82	14.82
5*	14.77	14.19
10	12.90	11.85
15†	10.59	8.95
17	9.48	7.39
19	5.06	3.59
21	0.25	0.16
22	0.17	0.11

*This value is computed for 1 gm. after operating on 0.6261 gm.

†This value is computed for 1 gm. after operating on 0.8991 gm.

the residue, insoluble in acids and alkalis. The results of this determination are given in Table IV.

Comparing Fig. 2 and 4 we note that the two curves have the same general trend and that, aside from the stronger reaction of hydrochloric acid, the results of the two methods can be compared. We have, therefore, again resumed our tests of decomposition, this time making use of a Barthel burner No. 4 giving a temperature of 980 to 1040 deg. C. when half turned on, the flame burning in a refractory tube about 10 c.c. in diameter. A 1-gram sample was used.

After two hours' heating the insoluble residue in hydrochloric acid and in sodium carbonate was 4.56%. After one hour's decomposition it was 5.57%. These two tests deal with conditions similar to section 18 of the kiln. The lumps formed upon calcination are hard, have a sandy appearance and show black dots, identical with those encountered in samples from 20 and 21. When immersed in water, these lumps show no swelling.

After 50 minutes' heating the sample does not effervesce when moistened, and shows no black dots. Treated with hydrochloric acid and sodium carbonate, it gives a 6.16% insoluble residue. This test approaches the conditions at 17. Heating for 20 min.—period used by Hendrick—reproduces conditions at 17 yielding 6.78% residue. Selecting 20 min. as heating period and assuming the sum of $SiO_2+Al_2O_3+Fe_2O_3$ of a sample taken at the charge opening of the kiln as 21.54, we obtain the following formula for "aptitude to calcination":

$$\text{Apt. to Calc.} = \frac{AI \cdot 3.7 \cdot 100}{\text{Total carbonates } (7.6+IR)}$$

Where $AI = SiO_2+Al_2O_3+Fe_2O_3$; 3.7=a coefficient which serves to balance the activity of clayey constituents with that of carbonates—the cement mixtures generally containing 1 part of clay to 3.7 parts carbonates—the total carbonates constituting the value of this coefficient 100—a factor introduced in order to obtain values greater than unity; 7.6—a constant computed by Hendrick in comparing the products of two plants; IR—the insoluble residue weighed after decomposition.

$$\text{Apt. to Calc. A.C.} = \frac{21.54 \cdot 3.7 \cdot 100}{76.50\ (7.6+6.73)} = \frac{7969.8}{1100.07} = 7.24$$

One sees at a glance that the two formulas—that for index of refractiveness and that for aptitude of calcination—yield contradictory results. The former represents the resistance offered by the sample to clinkerization, while the latter denotes its aptitude to calcination, i.e., its relative ability to combine and form clinkers. Both results being purely theoretical values, they are used merely for comparison and as an aid to the engineer. For reasons mentioned above, the formula for aptitude to calcination will be taken as the standard formula in the following discussion. To improve the aptitude to calcination—raise its value from 4 to 8—means facilitating the work of the kiln by making the material more readily calcined. The higher the aptitude to calcination—also called the coefficient of calcination—the easier is the process of calcination and vice versa.

Variation of the Coefficient of Calcination

(a) *Effect of Insoluble Residue.* Let us assume a sample having a total carbonate content of 77%, a clay content of 21%, its coefficient of calcination, assuming that the insoluble residue is zero, will be:

$$\text{A. C.} = \frac{21 \cdot 3.7 \cdot 100}{77\ (7.6+0.0)} = 13.3$$

When the insoluble residue is equal to 1%, we have

$$\text{A. C.} = \frac{21 \cdot 3.7 \cdot 100}{77\ (7.6+1.0)} = 11.7$$

TABLE V.

Insoluble residue	Aptitude to calcination
0	13.3
1	11.7
2	10.5
3	9.5
4	8.7
5	8.0
6	7.4
7	6.8
21	3.2

Table V gives the values of this coefficient for different percentages of insoluble residue. The results are plotted in Fig. 5. The curve descends rapidly at the start, its slope then gradually flattens out and it runs off asymptotically at 3.2, which represents the case of 21% insoluble residue. In practice for the conditions assumed the aptitude to calcination will be always higher than 3.2, for even if the 21% "clay" consist of silica, crystalline or amorphous and coarse—these coarse particles will show a slight reaction at the surface and the insoluble residue will not reach 21%.

If the axis D B represented values of temperature of clinkerization and were arranged with increasing values from D to B, the curve AB would represent the temperatures of clinkerization of these samples as the temperature of clinkerization varies with the physical-chemical properties of the calcined mixture, i.e., it is directly dependent on the aptitude to calcination of the mixture.

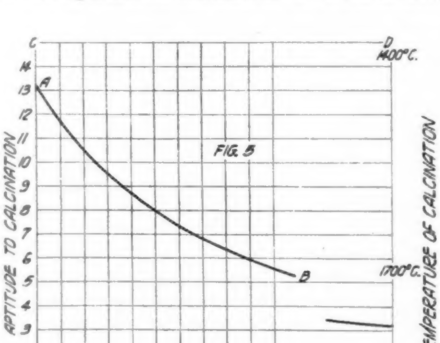


Fig. 5—*Effects of insoluble residue on aptitude to calcination*

$T = f$ (A. C.) The temperature of clinkerization is a function of the aptitude to calcination.

(b) *Effect of Proportions.*

(1) Constant Insoluble Residue. Assume a paste having 5% insoluble residue, 21% clay and 77% carbonates. The aptitude to calcination will be $\frac{21 \cdot 3.7 \cdot 100}{77\ (7.6+5.0)} = 8.0$. Supposing that the proportion of carbonates is raised to 77.5%, the clay being 20.5% and the insoluble residue 5%, the aptitude to calcination will be $\frac{20.5 \cdot 3.7 \cdot 100}{77.5\ (7.6+5.0)} = 7.7$; if we raise the proportion of carbonates to 78%, the clay becomes 20% and the insoluble residue remains 5%, the aptitude to calcination becomes 7.5. On the other hand, if the proportion is reduced to 76.5%, the aptitude to calcination becomes 8.25. We may, therefore, conclude, that, assuming a constant insoluble residue, the aptitude to calcination varies inversely as the carbonate content, i.e., it decreases with increased carbonate content and vice versa. This case is never encountered in practice.

(2) Variable Insoluble Residue. Assume a mixture having the following characteristics: Clay 20%, total carbonates 78%, insoluble residue 2%, the aptitude to calcination is: $\frac{20 \cdot 3.7 \cdot 100}{78\ (7.6+2)} = 9.9$.

If, dealing with the same materials, we use 77% carbonate and 21% clay, the insoluble residue, varying directly with the oxides will become $\frac{2 \cdot 21}{20} = 2.1\%$. The aptitude to calcination will then become: $\frac{21 \cdot 3.7 \cdot 100}{77\ (7.6+2.1)} = 10.4$. If the proportion is further reduced to 76%, the aptitude to calcination similarly becomes: $\frac{22 \cdot 3.7 \cdot 100}{76\ (7.6+2.2)} = 10.9$. Therefore, dealing with the same materials and proportioning the carbonate content of the mixture successively as 76, 77, 78%, we obtain aptitudes to calcination of 10.9, 10.4 and 9.9 respectively, which demonstrates that raising the proportion of carbonates leads to mixtures whose calcination is increasingly difficult. The observations collected in practice confirm this statement.

Supposing that we have a rotary kiln perfectly adapted to a mixture of 21% clay, 77% total carbonates and 3% insoluble residue, whose aptitude to calcination is 9.5. Let us suppose that under these conditions the kiln yields a good product, manufacturing a clinker which is well burned and stable, and that the average life of the lining is preserved. If we should wish to obtain equally good results with a mixture containing 78% carbonates and 20% clay, we will have to keep the aptitude to calcination at its original value of 9.5. This can be done by reducing the insoluble residue within the limits indicated below:

$$9.5 = \frac{20 \cdot 3.7 \cdot 100}{78\,(7.6 + x)} \text{ or}$$

$$9.5[(78 \cdot 7.6) + 78x] = 20 \cdot 370$$

and $x = 2.4$.

To keep the same aptitude to calcination we will, therefore, have to bring the insoluble residue of the mixture from 3 to 2.4% in raising the proportion of carbonate from 77 to 78%.

Improving the Aptitude to Calcination of the Mixes

The aptitude to calcination of a mix may be improved by different means:

(1) *Addition of Flux.* The addition of iron oxide to mixes fusible with difficulty raises the aptitude to calcination of the mix. This method, however, cannot be generally recommended, as it brings good results only when the primary ingredients have a low iron content, and may become extremely annoying should the iron content exceed a certain limit. We would advise to avoid strong concentrations of iron and attach great importance of the modulus $\frac{Al_2O_3}{Fe_2O_3}$ which will always be greater than 1.1. Care should be taken that the oxides or other fluxing materials are uniformly distributed in the paste.

(2) *Elimination of Sand.* The elimination of quartz constituents of a mix greatly increases its aptitude to calcination. This is easily understood, as the reaction of sand particles is slow and takes place gradually. Depending upon the size of particles, this reaction may take place during the entire period of calcination and may not even be completed then. A paste containing 1.26% silica had an aptitude to calcination of 6.44; upon removal of this sand, the value of the latter was raised to 6.94.

(3) *Fineness of Mix.* The fineness of the mix plays an important part in determining the aptitude to calcination. Increased fineness of grinding greatly reduces the insoluble residue. A paste having 12% residue on the 180x180 sieve and an insoluble residue of 7.15%, when ground until only 4% are retained on the above sieve, has an insoluble residue of only 4.97%. Special care shall be taken to obtain satisfactory fineness of the paste as it greatly influences the fusibility of the latter. Greater fineness increases the reacting surface area, makes the chemical reactions more rapid and thus facilitates the chemical processes in a rotary kiln. The reactions are completed more easily and do not require excessive temperature. The more complete are the reactions taking place in the relatively cold zones of the kiln, the better digested is the mix on arriving at the zone of clinkerization and the easier is the work in the latter zone. Laboratory tests have shown the important effect of fineness of the raw mix and have reproduced the results obtained in practice.

(4) *Homogeneity.* In increasing the fineness of the raw mix one effects at the same time greater homogeneity of the mix, i.e., one obtains a more perfect mixture of calcareous and argillaceous constituents. A mix can never be too homogeneous. As the stability of clinkers depends primarily on the homogeneity of the mix, one could not overemphasize the importance of this factor. A certain proportion of carbonate recommended by the laboratory instructions for a certain kiln, does not imply a molecular state of homogeneity. Thus, a paste mixed from chalk and schist will be homogeneous only when the schist is ground very fine and the acid and basic elements are uniformly distributed throughout the paste. The ideal state of homogeneity is reached when one molecule of acid constituent is surrounded by 3.7 molecules of carbonate. Great importance must be attributed to homogeneity and fineness of the mix.

(5) *Physical State.* The chemical composition of a mix influences its behavior when calcined in the rotary kiln. Mixes with relatively low silica modulus $\frac{SiO_2}{Al_2O_3 + Fe_2O_3}$ and flux modulus $\frac{Al_2O_3}{Fe_2O_3}$ are generally easily calcined. Raising the values of these ratios renders the mass more resistant to burning. The same applies to the proportion of carbonates. However, the chemical composition is not the only criterion determining the relatively high or low aptitude to calcination of a mix. Two mixes of the same chemical composition may not always show the same behavior during calcination. The physical state of the mix should be taken into account. We have thus encountered two schists having the same chemical composition and acting in an entirely different manner when calcined in a mix of identical chemical composition. While one yielded a paste whose calcination proceeded normally, the other presented great difficulty in calcining. These schists differed in their metamorphic state, one being relatively soft, while the other had a coarser texture, was hard and showed only slight cleavage. The aptitude to calcination of the former was 7.2, that of the latter only 6.44. In conclusion let us note:

(a) That the cement industry is essentially a chemical industry and that the quality of its products depends upon the care given to their manufacture.

(b) That in the ternary system: Silica-alumina-lime of actual portland cements one encounters combinations endowed with exceptional hydraulic properties.

(c) It is of great importance to check the variations in chemical composition of the mixes and it is essential to study their properties and the physical chemical constants. Our tests made in this connection have shown that studies of the index of refractiveness and aptitude to calcination may yield such remarkable results as the improvement of an ordinary portland cement having at 7 days tensile strengths of 1:3 mortar of 376 lb. per sq. in. as an average. (A. S. T. M. Robert W. Hunt, 5 tests: 370-370-360-390-390.) This value is exceeded by a special cement yielding at 7 days a tensile strength of 31.75 kg. per sq. in. or about 453 lb. per sq. in. on mortar specimens conforming to A. S. T. M. standards.

(d) It is equally important to supervise the operation of rotary kilns and insure the manufacture of a perfectly calcined clinker. The kilns should be operated without interruptions and as regularly as a clock. *The coal should be carefully selected.* Its content of volatile matter should vary to suit the requirements of each individual case; it should be clean, dry and finely pulverized. The supply of fuel and air should be kept constant. The quantity of slurry admitted to the kiln should be regulated to avoid excess or deficiency of material. All efforts should be directed towards obtaining a uniform product: Unifomity of production and uniformity of quality.

(5) Fineness of grinding deserves special attention. We have shown above that the phenomena of setting and hardening of cement depend upon the hydration of silicates according to the equation:

$$3CaO \cdot SiO_2 + Aq = CaO \cdot SiO_2\ Aq + 2Ca(OH)_2$$

The rate of this reaction is proportional to the molecular concentration of the reagents. Assuming that the temperature and the quantity of water are constant, we will endeavor to raise the concentration of lime silicates to accelerate this reaction. The cement available in commerce is a powdered product of the grinding of clinkers and consists of particles of variable diameter.

Assuming a particle A of radius $r = 1$ placed in contact with water, we obtain an instantaneous reaction with the constituents of the particle. It is understood that the reaction will set in at the surface, progressing gradually to the interior by solution of the lime liberated in the reaction of the calcium silicate crystals. The inner zones thus cannot react instantaneously and their reaction becomes apparent only after some time. This particle of radius r will have a volume $v = \frac{4 \cdot 3.14 \cdot 1^3}{3} = 4.19\ v$ (where v is the unit of volume) and will present to the water a surface area $S = 4 \cdot 3.14 \cdot 1^2 = 12.56\ s$ (where s is the unit of area). Reducing this particle to particles of radius $r = \frac{1}{2}$, we obtain a volume of particle $v' = \frac{4 \cdot 3.14}{3} \times \frac{1^3}{2} = 0.52\ v$; the particle of $r = 1$ will thus contain $\frac{4.19}{0.52} = 8$ particles with radius $r = \frac{1}{2}$. The surface s' of these particles of radius $r = \frac{1}{2}$ will be $s' = 4 \cdot 3.14 \cdot \frac{1^2}{2} = 3.14\ s$. The 8 particles of radius $r = \frac{1}{2}$ contained in one particle of radius $r = 1$ will have an area $3.14\, s \cdot 8 = 25.12$, i.e., twice that of the primary particle. Thus,

in reducing the radius of a particle to one-half of its original value we double the surface area of the particle. Let us continue reducing the radius of particle to $r=\frac{1}{4}$. The volume of these particles will be $v''=\frac{4\cdot3.14}{3}\cdot\frac{1^3}{4}=0.065\ v$; the surface will be $s''=4\cdot3.14\cdot\frac{1^2}{4}=0.785\ s$. The particle of radius $r=1$ will contain $\frac{4.19}{0.065}=64$ particles whose $r=\frac{1}{4}$; the surface thus obtained will be $0.785\cdot64=51.64\ s$ or $\frac{51.64}{12.56}=4$ times that of the original particles with $r=1$.

TABLE VI.

$r=$	½	¼	⅛	1/n
S=	2S	4S	8S	nS
V=	V/8	V/64	V/512	V/n^3

The impalpable particles of infinite fineness will have a radius 1/n and a volume V/n^3. The surface of these particles compared to that with radius $r=1$ will be nS or infinitely greater. An equal weight of cement P will offer a reacting surface S increasing with the fineness of particles.

The value of cement as a hydraulic binder can be greatly increased by introducing a rational specification for fineness.

We have little confidence in the method now in use in comparing the fineness of cements. Cements ground from the same clinker and having the same residues on the 200x200 sieve may nevertheless give widely different results in practice. We offer the following explanation: Let us assume 3 cements ground from the same clinker, 90% of which pass the 200 sieve in each case. Let us also assume that the 10% residue on this sieve is composed of particles of equal size whose hydraulic value is equal to zero. Cement I may be composed of 90% particles of radius $r=1=$ to the opening of the 200 sieve and of 10% particles with greater radius. Basing our computations of reacting surface on the 90% passing the 200 sieve, we obtain $S=90\cdot4\cdot3.14\cdot1^2=1130.4S$.

Cement II will also contain 10% waste, but the other 90% may be constituted as follows: 45 particles of radius $r=1$; $35\cdot8=280$ particles of radius $r=\frac{1}{2}$ and $10\cdot8^2=640$ particles of radius $r=\frac{1}{4}$. The total reacting surface will be:

45 particles of radius $r=1$ or $45\cdot12.56S = 565.2S$
280 particles of radius $r=\frac{1}{2}$ or $280\cdot3.14S = 879.2S$
640 particles of radius $r=\frac{1}{4}$ or $640\cdot0.785S = 502.4S$
1946.8S

Cement III may have the following characteristics: 10% residue, 10 particles with radius $r=1$; $30\cdot8=240$ particles with radius $r=\frac{1}{2}$; $40\cdot64=2560$ particles with radius $r=\frac{1}{4}$ and $10\cdot512=5120$ particles of radius $r=\frac{1}{8}$.

The reacting surface will be:
10 particles of radius $r=1$ or $10\cdot12.56S = 125.60S$
240 particles of radius $r=\frac{1}{2}$ or $240\cdot3.14S = 753.60S$
2560 particles of radius $r=\frac{1}{4}$ or $2560\cdot0.785S = 2009.60S$
5120 particles of radius $r=\frac{1}{8}$ or $5120\cdot0.19625S = 1004.80S$
3893.60S

When mixed with water, these three cements will show great variation in the rate of hardening. In reducing the size of particles and increasing the fineness of grinding, we have raised the activity of cement and accelerated the reactions of hydration and hardening. The strengths yield relations as shown in Fig. VI.

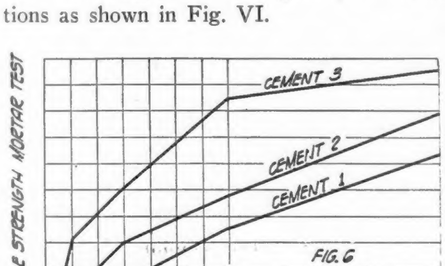


Fig. 6—Effects of various types of grinding on strength of cement

This test can be easily duplicated in practice. Cement I may be ground in the so-called granulating mill; cement II in a ball mill, while cement III should be ground in a laboratory mill, taking care in replacing the charge successively by balls of smaller diameter.

The following conclusions may be drawn from this test: An effort should be made to obtain the maximum possible quantity of finest elements. The proportion of this extremely fine material depends also on the nature and hardness of the clinkers, as well as on the apparatus used in its action; compression, shock, pressure and friction, friction and abrasion.

The data given above permit us to conclude that the sieve analysis of cement does not give an accurate indication of the actual value of the product and that a method should be sought which will enable us to judge the surface development of a sample; in other words, which would give measurements of the surface area presented by the sample to the attack of water. This method is unfortunately Utopian and we will have to limit ourselves to comparative fineness determinations. The fineness of cement is not a measurable quantity. Instead of the sieve analysis we would prefer to use the Schone levigation apparatus used for clays. This apparatus would permit us to separate the sample into numerous fractions and to represent its fineness by a graph. However, this is not a problem within the realm of an industrial chemist and should be investigated by machine designers in the different cases encountered. They could then use the fineness curves in advertising their machinery and would facilitate the choice of machinery for the cement manufacturer. Sieves would be used only for check tests during manufacture; they would thus occupy a secondary position which is theirs by right.

Bureau of Mines Activities in Rock Products Field

CONTINUATION of the educational campaign designed to decrease the death and injury rates among the million miners of the United States was the predominant feature of the activities of the Federal Bureau of Mines during the fiscal year 1926, the first year in which the Bureau functioned under the Department of Commerce. Substantial progress was achieved in the movement for the rock-dusting of bituminous coal mines as a preventive of explosions, a great number of the larger mines having adopted this safety measure. A striking instance of the efficacy of rock-dusting was afforded in the explosion in the New Orient coal mine in southern Illinois in January, the employment of rock-dust localizing the explosion and holding the number of deaths to five at a time when approximately 1,000 men were at work in the mine.

The Safety Extension Service was established during the year. Its chief functions are to bring before the industry the Bureau's recommendations on rock-dusting bituminous coal mines, the use of closed lights, advanced mine rescue training, mine safety organization, and the purpose of the Holmes Safety Association; also to conduct field demonstrations of the explosibility of coal dust and the use of rock-dust as a preventive of mine explosions.

In many places mine workers in other than coal mines are seriously menaced by harmful dusts and lack of ventilation. The Bureau is studying ventilation conditions in various mines throughout the country.

Chemists at the Pittsburgh experiment station have developed a new respirator which is believed to be superior to other devices as a means of protecting wearers from injurious dusts.

Actual production of shale oil has begun at the experimental oil-shale plant established near Rulison, Colorado, as the result of special Congressional legislation. American-type and Scottish-type retorts are being operated for purposes of comparison. It is hoped that the operation of this experimental plant may be an important step in the development of an American shale oil industry.

At its New Brunswick (N. J.) experiment station the Bureau is studying methods for the utilization of small limestone fragments now wasted at lime plants. In view of the wide use of mica in radio and electrical equipment, better methods for the mining and preparation of this material are being investigated.

Burning Magnesite in a New Form of Kiln

Spokane Plastic Magnesite Co. Uses a Calciner to Burn Magnesite as Lime Is Burned

PLASTIC magnesia is a fairly quick-hardening cementing material used for stucco and for flooring. It makes an especially good floor, for when mixed with the proper aggregates, sawdust asbestos and diatomaceous earth, it is hard enough to resist wear and yet it is easy to walk on, being somewhat resilient. It is imported from Greece and India, and a considerable amount is produced on the Pacific coast of the United States.

The Spokane Plastic Magnesite Co. of Spokane, Wash., has been engaged in the manufacture of magnesia stucco and flooring for some little time, buying its magnesia already prepared for mixture with other materials. Recently the company has built a calcining plant a short distance from the city in which it will treat crude magnesite from the quarry of the Northwest Magnesite Co., which is at Chewelah, about 60 miles north of Spokane.

Crude magnesite looks like limestone and resembles it chemically. That is, magnesite is a carbonate of magnesium, as limestone is a carbonate of calcium. Both are burned to remove carbon dioxide and thus change the carbonate to an oxide, and after burning both have plastic or mortar making qualities. Both are also caustic alkalies after burning. But magnesite has to be more carefully burned than lime and with a closer control of temperature, for if it is overburned it becomes "dead burned magnesia," which is valuable as a refractory but which has no cementing properties.

The carbon dioxide begins to leave the crude magnesite at about 1000 deg. F. and with increasing rapidity until 1400 deg. F. is reached. After that it begins to "dead burn." Hence the calciner should be one in which the temperature may be easily and quickly controlled.

A New Form of Calciner or Kiln

The calciner in this new plant is a modified form of the Herreshoff roaster, a furnace which has been used for many years in calcining the "concentrates" of copper and other ores. It is a continuous furnace and adapted only to fine material. R. D. Pike of San Francisco has modified it for use on non-metallic minerals and in this form it is reported in successful use both for burning magnesite and portland cement.

The calciner consists of an upright cylinder about 20 ft. high and 12 ft. in diameter. It is lined with fire brick and has seven horizontal partitions or hearths on each of which a set of rabbles revolve. These rabbles, or rakes, not only stir the material but move it in toward the center or away from the center, according to the way they are set. On one hearth they move the stuff away from the center so that it falls down holes along the side wall and on the next hearth they move it inwardly so that it falls down a hole near the center. All the rabbles are attached to one shaft which are moved by a gear below.

The lower hearth has a different arrangement from that just described. The hearth moves and the rabbles are stationary. As on this hearth the temperature is greatest, the rabbles are made of a heat-resisting alloy called "hibnickel" and they have a special cooling device. All the rabbles are cooled by air which is blown through the hollow center shaft and through the arm which supports the rabbles.

The crude magnesite as received has been dried and ground to pass a 10-mesh screen, which means that about 60% will pass a 50-mesh screen. Naturally there is considerable dusting during the process of calcining. The dust is all caught in a Cottrell precipitation apparatus, and it is sufficiently cal-

Plant of the Spokane Plastic Magnesite Co., Spokane, Wash.

cined so that it can be added to the product. The calciner was made by the Pacific Foundry Co. and the precipitators by the Western Precipitation Co.

The Cottrell precipitation process is one that has been in use for years to collect dust from smelters and cement plants. It employs an electric current of very high voltage, sometimes as much as 100,000 volts, and the dust particles are attracted and held by the electrostatic effect. The Northwest Magnesite Co. has a very large plant of this kind attached to the rotary kilns in which it dead-burns magnesite.

After burning, the plastic magnesite should show a "loss by ignition" of 4% to 5%, and burning is judged by this test.

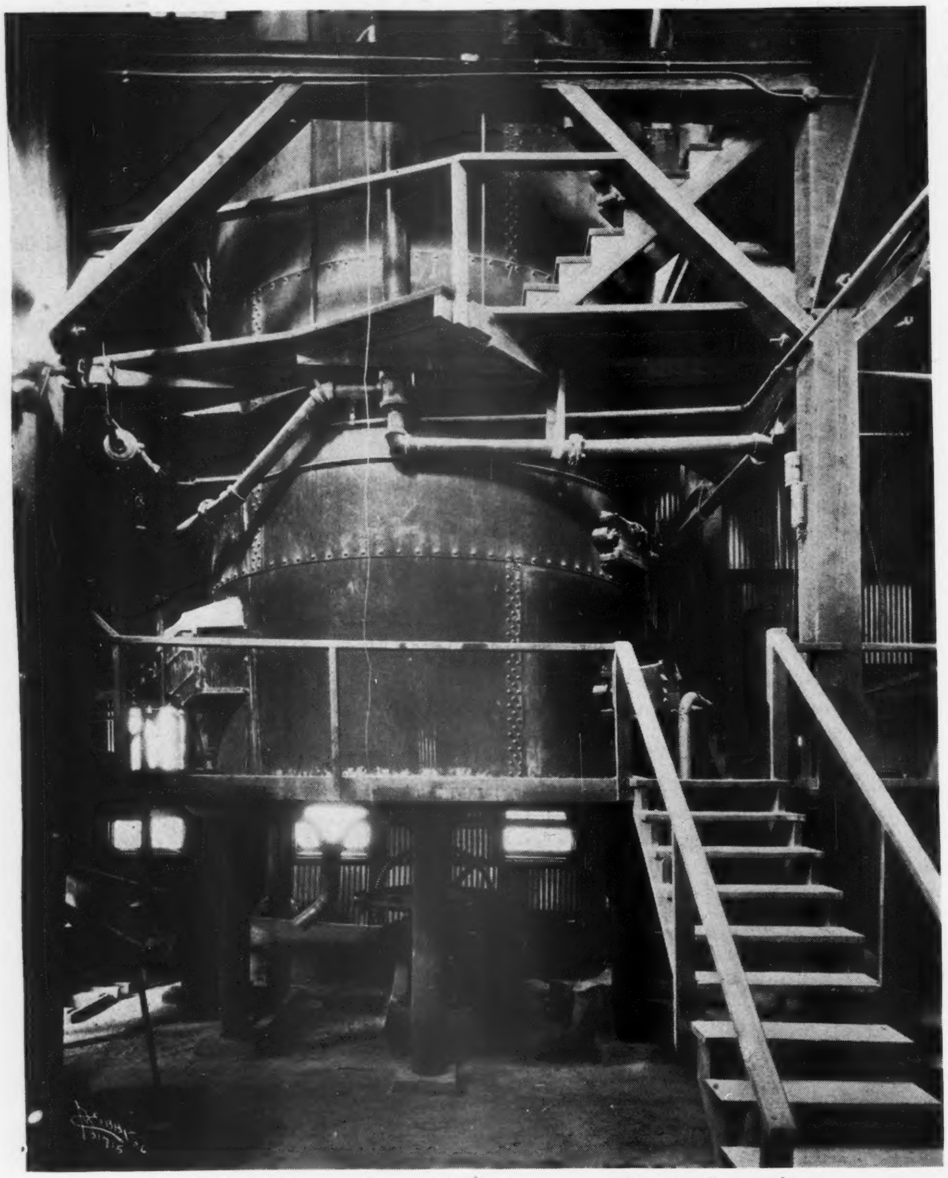
The crude magnesite is received in box cars which are unloaded into a hopper below the track. It is picked up by an elevator and sent to a bin which holds 40 carloads. This storage capacity is to insure steady operation of the plant regardless of weather and railroad conditions.

From the bins the magnesite goes to a conveyor belt 12 in. wide, which is in a concrete-lined tunnel below the bins. This discharges to the boot of a 12-in. bucket and belt conveyor which lifts it to the calciner bin.

The feed from the bin to the calciner is regulated in a simple but accurate manner. A spout from the bin terminates above a plate which is close enough to the spout and sufficiently large to prevent the magnesite from running out of the bin. A bar on the rabble arm wipes over this plate as the rabbles revolve and pushes some of the magnesite on the hearth, and more magnesite flows out on the plate from the spout ready for the next time the bar comes around. By setting the bar in and out the amount of feed pushed off at each passage may be closely regulated.

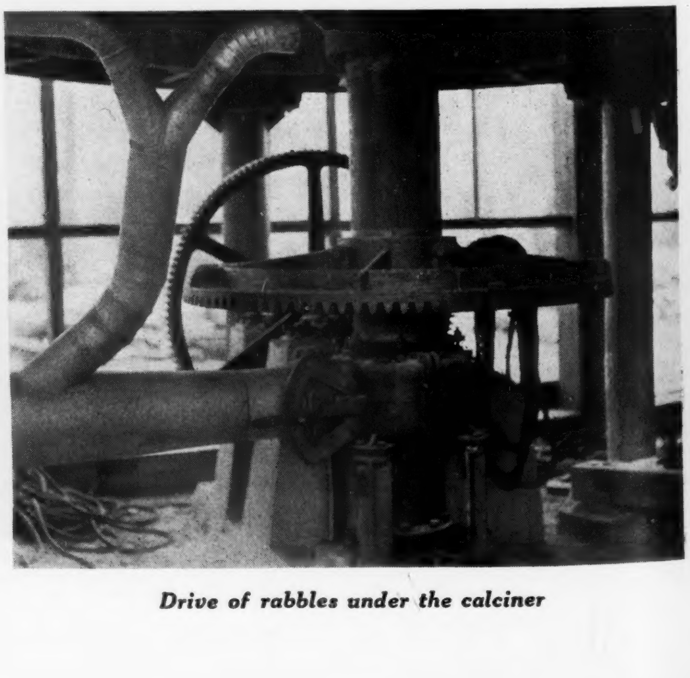
Oil is used for fuel, but there are burners on the two lower hearths only. The others are heated by the hot gases that rise from one hearth to the other through the same openings along which the feed passes. There are two burners on each of the "hot" hearths. The oil is atomized and forced through the burner by air from a pressure fan driven by a 10-hp. motor.

The rabbles move slowly and very little



The calciner, a form adopted from metallurgical practice

A fan draws cold air through the rabbles

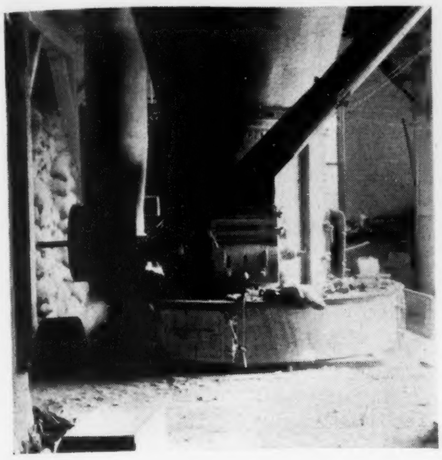


Drive of rabbles under the calciner

power is needed to turn them. A 5-hp. motor is used for the drive, but the actual power consumption is about 3 hp. A 10-hp. motor drives the fan that is used to control the rabble arms.

After calcination the hot magnesite flows into a screw conveyor 45 ft. long, which serves as a cooler. From this it passes to a hot elevator which lifts it to the Raymond mill bins.

The Raymond mill has five rollers and



Mill for grinding calcined magnesite

is of the high sided type. It is provided with the usual air separation devices and practically all of the product will pass a 200-mesh screen.

The Raymond mill discharge goes to a steel bin which holds two carloads and which is lined with magnesite blocks. This bin is tight and moisture-proof. Below it is a Bates valve bag sacker and a conveyor that takes the filled sacks to a car or to the warehouse.

The company has a tube mill in which it has ground some magnesite and in which it

Arrangement of crushers in aggregate plant

does commercial grinding of other products.

The mixing department has been equipped with a new type of mixer and arrangements for feeding the magnesite and the other constituents of flooring and stucco. These are sand, diatomaceous earth, sawdust, asbestos and mineral colors. The proportions vary according to the product. For example, the diatomaceous earth is not needed when much mineral color is used. Special devices have been introduced to prevent aggregation of the materials.

Both flooring and stucco are shipped to dealers and to contractors. Flooring is usually applied by contractors who make a specialty of such work and who have their own ideas of the mixture that should be used and therefore much of this material is especially mixed to specifications.

Finishing aggregate for stucco is also made by this company. For this purpose it has a very neat little plant at the end of the warehouse. The raw material is marble (said to be dolomitic) from Valley, a town about 50 miles north of Spokane. This marble comes in all colors, red, pink green, a bluish black and a brilliant sulphur yellow. A white marble from Lewiston, Idaho, is also crushed. This is a coarsely crystalline marble that breaks along the faces of the crystals, giving it a glittering appearance.

The marble is fed into a 9x12-in. Blake type jaw crusher and elevated to a cylindrical screen 30 in. in diameter and 24 ft. long. The oversize goes to another small jaw crusher which is unusual, since it is of the Dodge type. The last section of the screen has 1-in. holes, and the material which passes these goes to a pair of 20x12-in. rolls. The discharges all pass to the same elevator to be lifted to the screen.

There are seven sections to the screen covered with wire cloth from ⅜-in. down to 40-mesh. Each makes a product that is sent to a small bin with a spout for sacking. The finest size is run over a small shaking screen to take out the dust.

The product is sold for use with the company's magnesite stucco or to dealers for use with other stucco material.

All the machinery in this plant was made in Spokane by either the Union Iron Works or the Halladie Machine Co.

The office of the company is in Spokane, at Ruby and Mallon streets. W. G. Ramage is president; L. R. Gillogly, vice-president, and N. W. McCormack, secretary-treasurer.

Plant which makes aggregates for stucco

Steam in Gas Producers Compared With Waste Gas Containing Carbon Dioxide

Increasing Efficiency and Lime-Fuel Ratio by Partial Substitution of Waste Kiln Gas for Steam in Gas Producer

By Victor J. Azbe
Consulting Engineer

THROUGH an extensive series of tests, the author of this article has concluded that the use of excessive amounts of steam in the gas producer results in reducing the efficiency of the producer and cuts down the lime-fuel ratio. From his experiments, he has found that CO_2 can be more easily decomposed in the producer than steam and at the same time it is equally as good in keeping the producer from clinkering. He suggests the introduction of waste kiln gases containing CO_2 gas into the producer to replace to a large degree the steam.

QUITE generally the endothermic agent used to keep down the temperatures of the hot zone in gas producers below the fusing point of the ash is steam. It is quite satisfactory, when considering the primary purpose only, that is, keeping the producer from clinkering; in all other respects its use is objectionable wherever hot gas is to be used.

If steam generation would be inexpensive, if all steam in passing through producer would be decomposed and so utilized, if the reaction would always be according to

$$C + H_2O = CO + H_2$$

and not

$$C + 2H_2O = CO_2 + 2H_2$$

and if hydrogen would not have other objections and few advantages, then the use of steam would be proper; but since this is not the case, a substitution for steam, or at least a reduction in the amount of steam used, should be put in effect wherever possible.

Disadvantages of Steam Made Gas

When a separate boiler is used to generate steam, in most lime plants at least, the attention paid to this boiler is such that it is doubtful if efficiency higher than 55% is attained. When steam is used for other besides gas producer purposes, the saving accomplished by substitution for steam as endothermic agent is not quite so great, but still well worth while; the main aim, however, should be entire elimination of steam used in the plant if the central station power rates are low enough.

When a boiler is operated for purely gas producer purposes, steam-coal is ordinarily from 15% to 20% of total coal burned, the lime-fuel ratio is reduced about ½ lb. per pound of coal due to this alone, without considering other disadvantages created by the quality of steam-made gas.

Disadvantageous as it may appear, separately produced steam, when reasonable care in its generation is taken, is to be preferred to steam made by the jacket producers. The heat abstracted from the gas and producer fuel bed by convection and radiation to generate steam would all have been available for making lime. It is the heat of high elevation, none of which would appear at the kiln preheating-decomposition zones junction. Quite frequently producers operate with ¾ lb. of steam per pound of coal burned to heat the water up to evaporating temperature, and as the latent heat of evaporation amounts to around 1130 B.t.u. per pound of steam, the heat abstracted is thus 850 B.t.u. per lb. of coal gasified. Since to decompose sufficient calcium carbonate to make 1 lb. of lime requires 1378 B.t.u. and since all of the heat abstracted by generation of steam would be used for lime making, the reduction in lime-fuel ratio under these conditions is .62 lb.

Opposed to this is the fact that separate boilers are wasteful, firing periodic with excess air or incomplete combustion, more labor is required and radiation losses greatly increased.

In most plants steam used for the producer serves a twofold purpose—it supplies the energy to blow the air and it cools the hot zone in the producer. As a rule, far more is used for the second than is required for the first. In any case, air blast could be produced much more cheaply and efficiently by mechanical than steam or even turbine blowers.

The essential purpose of steam is the prevention of clinkers, resulting from steam decomposition and consequent cooling action. The ideal reaction is

$$C + H_2O = CO + H_2.$$

Steam is decomposed and carbon incompletely burned, but since more heat is necessary to decompose H_2O than is generated by the formation of CO, a cooling of the bed results.

Tests made by Bone and Wheeler demonstrate that in a 4-ft. fuel bed only about 50% of steam is decomposed. The above ideal reaction consequently becomes

$$C + 2H_2O = CO + H_2 + H_2O$$

Part of the steam appears in the gas and passes through the kiln without doing any good, only harm.

When producer hot zone is operated too cool, which unfortunately is normally the case, the reaction of steam and carbon becomes:

$$C + 4H_2O = CO_2 + 2H_2 + 2H_2O$$

The carbon in this case is burned to carbon dioxide making gas rich in hydrogen, carbon dioxide and water vapor but poor in the desirable carbon monoxide.

The heat-carrying capacities of the various gases at the temperature of 1600 deg. F., range as follows:

SENSIBLE HEAT B.T.U. PER POUND AT 1600 DEG. F.

Air	397.67
Oxygen (O)	359.42
Nitrogen (N)	409.31
Carbon monoxide (CO)	409.31
Carbon dioxide (CO_2)	419.34
Water vapor (H_2O)	921.80

It will be noted that water vapor, that is undecomposed steam and steam formed from combustion of hydrogen carries more than twice the heat for equal weight from the decomposition zone of the kiln than does nitrogen or carbon dioxide.

Rapidity of Combustion of Various Gases

Rapidity of combustion of hydrogen as compared with carbon monoxide and methane, is very great. According to Payman and Wheeler, the relative speed of flame of hydrogen gas is 485 cm. per sec. of carbon monoxide 125 and methane 67. The relatively low speed of combustion of methane may most probably be due to a required breaking down of CH_4 into C and $2H_2$ before combination with oxygen takes place, while the high speed of reaction of hydrogen and consequent high temperatures are undesirable with lime kilns where even under favorable conditions it is difficult to get a reasonable long kiln life.

It is well known that refractories do not last as long when fuels of high hydrogen content are burned such as for example, fuel oil, when the temperature of the flame does not seem to be excessively high. Why? Payman and Wheeler claim that surface combus-

tion takes place, the combustible gas and oxygen penetrate into the surface, hydrogen probably breaks down from molecular to atomic, thus greatly increasing its chemical activity to even far beyond the already normally high.

It is further pointed out by various investigators that radiation from CO flame is some 2½ times as great as from hydrogen flame. Radiation is important to heat transfer, more so in case of lime than ordinarily. A lime surface excludes gas from the decomposing inner carbonate, therefore, the film of gas surrounding the surface is swept off with greater difficulty due to continual replenishment from the inner portions. This dead film is no obstruction to the heat transmitted by radiation.

Heat Values of Air-Gas Mixtures

While the apparent heat value of hydrogen as compared with carbon monoxide is very high, this is misleading. What counts is the heat value of a cubic foot of combustible air-gas mixture and they compare as follows:

B.T.U. PER CUBIC FOOT OF MIXTURE

	Gross	Net
CO and air	95.3	95.3
H and air	97.0	82.0
CH_4 and air	95.8	86.4

The "net" does not consider latent heat of vaporization as available. Care must be taken however, not to charge off this both at this point and also at the boiler.

These arguments are not against hydrogen in the fuel, merely against conversion of sensible heat into hydrogen instead of carbon monoxide or oxidation of carbon to carbon dioxide and conversion of resultant heat into latent hydrogen form. The hydrogen itself in the natural fuel is very valuable, much more so than carbon and it is very desirable even if hard to control.

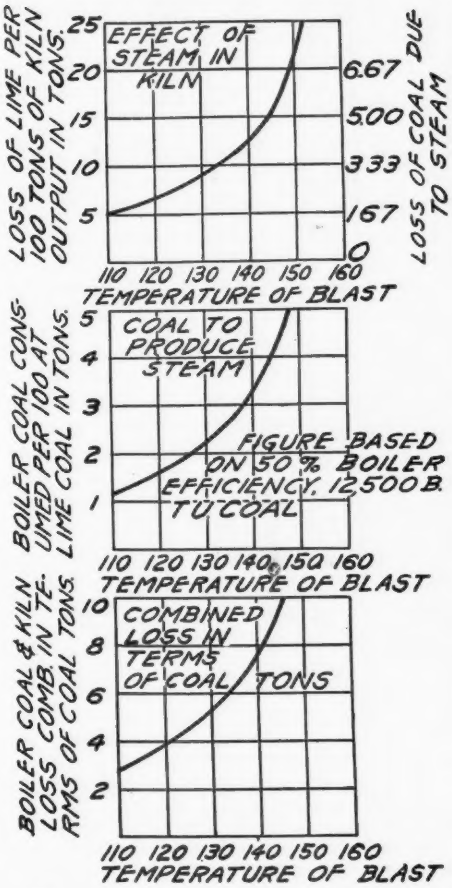
Reduction of the amount of hydrogen in the producer gas is possible by operating the producer so that the least steam is necessary. Thick and hot fuel bed is necessary, but more desirable would be entire elimination of all secondarily generated hydrogen; the only way this can be accomplished is by substitution of carbon dioxide for steam. Since pure carbon dioxide is not available, waste gas from kiln must be used but it serves the purpose satisfactorily.

Some advance views that kiln gas is undesirable due to the introduction of nitrogen gas with it which is an idle diluent. While it is true that the kiln gas mixture contains 30% of CO_2 and 70% N (nitrogen) by volume, by weight which counts, the CO_2 percentage is in the ratio of 40 to 60% of nitrogen.

Factors Offsetting Disadvantages of Nitrogen

The disadvantages of nitrogen is offset in many ways. Waste kiln or flue gas has a low specific heat and from this angle itself a weight more than twice as great as the weight of steam is permissible, but actually very little more is ordinarily necessary.

In the installation where the system was



Effects of steam on efficiency of gas producer operated lime plants. Chart A (upper)—Effect of steam in kiln; Chart B (center)—Coal consumption for steam generation; Chart C (lower)—Combined losses in boiler and kiln due to steam

tried by the writer, it was found that when CO_2 content in gas-air mixture was 5% there was no clinkering. At the same time the gas from producer contained only about 5% CO_2. Evidently decomposition of CO_2 in the producer can be accomplished much more thoroughly than decomposition of steam. Half of the steam passes through the producer without decomposing. One would expect this condition more from the study of equilibrium of gases. If one uses a substance (CO_2) which already is unavoidably present in preference to a substance which may be absent (H_2O), due to equilibrium influences the reduction of the first (CO_2) will be much more efficient. The law is that in the presence of carbon at a certain temperature and certain time of contact, CO_2, CO, H, H_2O should each be in such and such proportions. If the H_2O is left out entirely and H reduced, CO_2 will not increase the full proportion to the reduction of H_2O.

However, no matter what kind of endothermic agent is used, CO_2 from waste flue gas or steam from a boiler, it is harmful. Lime normally is not made below 1600 deg F. The agent which is necessary mainly to keep the producer from clinkering and only partially to reduce the temperature of the gas in the mains enters the producer at a temperature equal to 200 or 300 deg. while it escapes at a temperature of 1600 deg. F. It is this, together with the sensible heat loss from producer and mains that is responsible for the producer gas not being more efficient for purposes of high level temperature character, such as lime kilns are. It is evident that if the endothermic agent would enter the producer at the same temperature it leaves the hot zone of the kiln, it would do no harm and it would not matter particularly how little or how much of it would be used.

As was explained in the writer's paper entitled "Heat Distribution in Lime Kilns and Evolution of 'Ultimos'," (ROCK PRODUCTS, June 12 issue) there is more gas and heat leaving the decomposition zone than is necessary in the preheating zone. Consequently, the gas to be used in gas producers should be withdrawn at the junction of these two zones for the purpose described.

If it is found impossible to have a fully preheated endothermic agent, care should be taken to at least have it as hot as possible, all the additional heat that passes into the producer in a given weight of air eventually appears in the kiln at a high temperature level, all usable for limestone decomposition.

The harm of water vapor in gas is not realized primarily because a gas analysis never gives the water content. If vapor also would be determined, it would soon be found that gas of a high apparent heating value has often an actual value lower than that of an apparently poorer gas.

The harm of steam in gas-producer operated lime plants is well illustrated in the accompanying series of charts. These charts are calculated on the basis of a lime plant output of 100 tons.

Chart "A" illustrates the loss of capacity or the loss of fuel due to the ability of steam carrying heat from the decomposition into the preheating zone. The loss increases very rapidly as the temperature of the blast increases. At 145 deg. F., the loss is double that at 125 deg. F.

Chart "B" takes only the fuel necessary to generate steam in consideration. If the blast is 140 deg. F., then about 3.25 tons of coal will be needed to generate the steam in the boiler. The boiler coal will usually exceed 10% of total coal burned and may be as high as 15%. In some plants steam is generated by the producer itself; that is even worse because the most valuable heat in the producer is utilized to generate steam and to again bring the gas up in temperature naturally some of it has to be burned that otherwise would be useful in making lime.

Chart "C" combines the two sources of loss due to steam; that which occurs in the boiler due to generation of steam and that which occurs in the kiln due to steam application. It will be noted that in a 100-ton plant operated with 145 deg. F. blast the loss will be equivalent to 10 tons of coal per day or $40.00 if coal costs $4.00 per ton or $14,600.00 loss in one year.

Modern English Lime Plant

THE Aycliffe Lime and Limestone Co., Ltd., to meet the growing demand for lime, have recently put into operation a modern lime plant, capable of producing 60 tons of lime daily.

The plant, of which we show a photograph, consists of a vertical shaft, mixed feed kiln of the "Cornet" type. The limestone coming from the quarry is discharged into a large stone bin, capable of holding two days' supply; the fuel is likewise unloaded direct into two fuel bins. In this way all men handling in connection with the raw material is avoided. This, of course, materially reduces costs. Under these storage hoppers decauville tubs circulate, which after being loaded are conveyed direct to the charging house at the top of the kiln, by means of an electric lift. Here their contents are tipped straight into the kiln shaft.

The burnt lime is drawn by a simple ingenious method of curved bars. A circle through which the final product up to about 14 in. diameter falls, is formed when these are opened. One man can easily discharge 50 tons in eight hours with very little trouble. The bars are so arranged that the lime is withdrawn from the kiln in a regular manner and the whole charge descends the shaft in a uniform manner. Falling into a hopper underneath the kiln, which in turn feeds a jiggling table (which also serves as a picking belt) the lime is passed by means of a bucket elevator to a storage hopper, capable of holding two days' supply. A branch siding connects the plant with the main railway. The whole plant is electrically driven, and the general arrangement is such that labor charges are reduced to a minimum.

Low Fuel Consumption

The stone calcined in these works is the usual dolomite, which is so common in northeast Britain, whilst the fuel is Durham coke breeze. The consumption of fuel is just under 300 lb. to the ton of lime produced, which means a fuel ratio of about 8 to 1 is obtained.

The kiln consists of a vertical brick shaft, tied with steel straps, mounted on four concrete pillars of sufficient height to enable the hopper and jigging table to be built in underneath. The brick shell is lined with high-class firebrick blocks, specially made so as to contain the patented air recuperating flues. The blocks are of the largest size possible, consistent with easy handling. Experience has shown that disintegration invariably commences at the joints, so these blocks being large reduce the number of junctions very considerably. Between the lining and the outer shell is an insulating band, which serves the double purpose of preventing loss of heat by radiation and of taking up all expansion and contraction. Any cracking of the kiln wall is thus avoided.

A modern feature is the submerged chimney, made of steel, with a cast iron cone at the end entering the charge, fitted with a damper to insure a natural draught subject to regulation as desired. All gases are carried away by this chimney and the risk of carbon monoxide poisoning is eliminated. In ordinary practice the fire tends to creep up the kiln wall, unduly burning the firebrick, overburning the lime near the wall, leaving unburnt stone in the center of the kiln. These errors are corrected by the submerged chimney.

Situated at the bottom of the shaft is an air-cone. In kilns having a large output and fairly large diameter it is not uncommon to find the center part of the burden unburned. This is due to the inability of the air to reach the burning zone, and it is to remedy this defect that the air cone is introduced. Being conical in shape, it also facilitates the discharge of the lime.

Fire Control Devices

The air recuperating ducts control a portion of the air entering the burning zone. This new feature enables the lime burner to keep absolute control over his fire, particularly on occasions of "bad winds." If the fire creeps on one side of the kiln, the air can be shut off and increased on the side where the fire is low. The position of the fire can in this manner be stabilized.

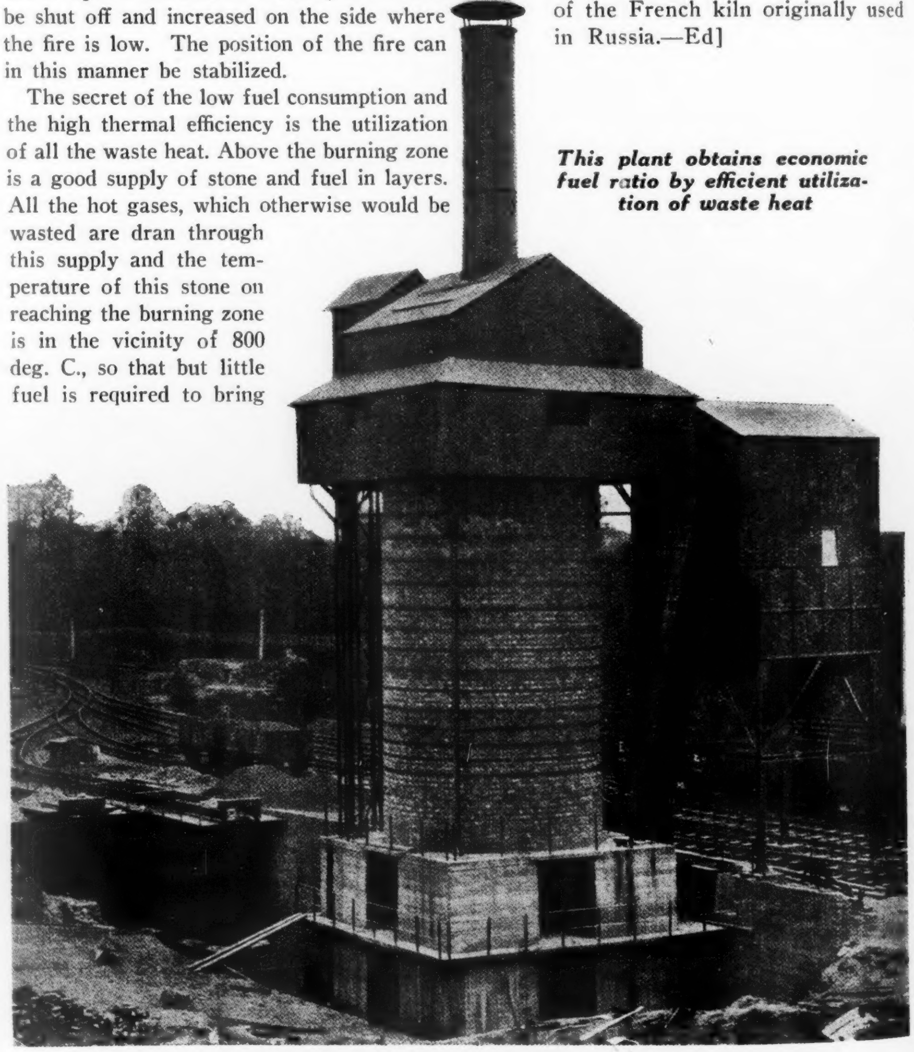
The secret of the low fuel consumption and the high thermal efficiency is the utilization of all the waste heat. Above the burning zone is a good supply of stone and fuel in layers. All the hot gases, which otherwise would be wasted are dran through this supply and the temperature of this stone on reaching the burning zone is in the vicinity of 800 deg. C., so that but little fuel is required to bring the limestone to the point of disassocation. The heat in the drawn lime heats the air entering by the grills and aircone, while heat which would be lost by radiation preheats the air admitted by the recuperating ducts.

Many advantages are claimed for this plant. It is easy to operate, cheap to maintain, needs very little labor and that mostly unskilled, is not adversely affected by "bad winds," no poisonous gases, produces large quantities, product is evenly burned, and the life of the refractory lining is much increased. But foremost, perhaps, is the very low fuel consumption.

The operation of the plant is continuous. When it is necessary to close down for weekends, holidays or through lack of orders, the kiln is merely damped down, by closing the tuyeres and the damper. The fire will remain in indefinitely with very little attention, thus obviating the drawing of the fire and rekindling.

The Kilns Construction Co., Middlesbrough, were the designers and builders of this lime plant.—Reprinted from *Stone Trades Journal (England)*.

[Readers of the articles of J. E. Duchez on lime kilns will note the resemblance of the kiln described here to the modern French type. The submerged chimney mentioned is the "plunging stack" of the French kiln originally used in Russia.—Ed]



This plant obtains economic fuel ratio by efficient utilization of waste heat

Quick Setting Lime Plaster and Lime Products

Some Recent Developments Patented by the National Lime Association

PATENTS covering the production of quick setting lime plaster through the use of metallic sulphates have been granted Major E. Holmes and G. J. Fink of the National Lime Association. Since the fundamentals involved in these processes have been already noted in this journal at various times, a brief resume will suffice. Specifically, the patents cover the production of

(1) plastic materials having quick initial setting properties which are prepared by slaking lime with water and a soluble sulphate of a metal which lies in groups 2, 6, 7 or 8 of the Mendeleef periodic table (best results being obtained with metals whose atomic weights range between 52 and 59, i.e., iron, 56, and manganese, 55);

(2) a prepared plaster mix having a quick initial set which is made by adding a metal carbonate which readily hydrolyzes and does not produce an appreciable amount of efflorescence. Magnesium and zinc carbonates give the best results and although the alkali metal carbonates such as sodium and potassium carbonates may be used, they yield plastics which effloresce and are not desirable addition materials unless used with de-efflorescing agents such as lead acetate, lead or zinc oxide and others. The patents, Nos. 1,604,574 and 1,604,575, covering these processes have been assigned to the National Lime Association.

A third patent, granted to F. C. Mathers and R. L. Hardy, relates to the production of plastic materials with quick initial set which are obtained by the addition of organic or inorganic sulphates and subsequent carbonation. In practice, carbon dioxide is introduced into a vessel containing hydrated lime, with or without the application of external heat, a temperature of about 50 deg. C. being desirable. Carbonation proceeds until the lime has a carbon dioxide content between 1½ and 6%, although from 2½ to 4½% is preferred. Various organic or inorganic sulfates (in this particular case, the best results have been obtained with aniline sulphate and manganese, ferrous and ferric sulphates) are added in a finely divided condition to the carbonated hydrate. The amounts of sulphate added are dependent on the particular setting time desired, increasing amounts accelerating the setting time. If desired a retarder such as sugar may be introduced. All this mixing is designed to take place at the plant and the dry plastic mix, as prepared, sent to the trade. For use, the regular amounts of mixing water, hair, sand, etc., are added and lime plaster made in the usual way.

In his process for making quick setting lime plaster (U. S. Patent No. 1,604,577), J. W. Stockett, Jr., uses only lime ingredients and no accelerating agents other than those already present in the hydrated lime and quicklime mixture. The product is prepared by adding hydrated lime to pulverized quicklime (100% through 50-mesh) and then introducing the required amount of mixing water. Excess water is avoided because as the patentee points out, the time of set is an additive function of the time for the material to dry plus the time of carbonation. Further, a lime putty on setting is accompanied by a shrinkage whereas his product is capable of expanding when it sets and hardens.

The patent continues:

Using my quick setting lime the scratch and brown coat may be applied during the same day and the finish coat the next day. In some instances the three coats may be applied the same day.

A quick setting mixture suitable for building blocks, tiles and the like is as follows:

Forty parts of finely powdered quicklime intimately mixed with 60 parts of hydrated lime plus the desired amount of water and such inert ingredients as wood fibre, sawdust, talc, limestone, asbestos and silica. This represents the preferred proportions which may be changed as the circumstances demand.

The solids may be first mixed dry and the water added to the mixture or the dry mixture added to the water. The most satisfactory results are obtained by first mixing the hydrate and sawdust with all the water required for the batch and then permitting the mixture to age until ready for casting into blocks, whereupon the quicklime is added. Cold water may be used but the most satisfactory results are obtained with the mixing water at a temperature of about 100 deg. F. The warm water is a good accelerator for the mixture. When using putty, the excess water should be just sufficient to be taken up by the quicklime which is added. This method of mixing permits the use of putty prepared from quicklime in lieu of that prepared from lime hydrate. The mode of procedure, therefore, in its preferred form, consists of preparing a putty from lump lime, mixing in the desired quantity of sawdust or wood fibre and then gauging the mixture with a predetermined amount of finely divided quicklime of about 50-mesh, just before pouring into the molds.

Blocks prepared from the above mixture may be made by any suitable block casting machine. In actual practice very satisfactory results have been obtained by the use of the Her-Born machine as used at the Sandusky, Ohio, plant of the Her-Born Engineering and Manufacturing Co.

In making large blocks 3x12x30 in., it was noted that the mix had a tendency to "bake" to the surface of the mold which was lined with aluminum. In an effort to reduce the surface friction between the mix and the mold several types of lubricants were tried, such as transmission oil, lard oil, light machine oil, stearic acid, beeswax and brown soap, but none of these were quite satisfactory. Excellent results were finally obtained by copper plating the aluminum cores and relining the molds with brass. In one run, blocks made of my mixture and cast in the Her-Born machine were ready to be ejected in the form of blocks in eight minutes. In another run, the mix was ready to be ejected in the form of blocks in 12 minutes.

Blocks cast with rectangular core spaces in a Her-Born machine and aged for a period of one month upon test gave the following results:

No.	Weight (Lbs.)	Per Cent Absorption (24 Hrs. Soaking)	C'mpr'ssive Str'ngth (lbs./Sq.in.)
9	22	50	87
11	21¾	60	70
15	21½	70	54

Blocks made with elliptical core spaces give the following results:

No.	Weight (Lbs.)	Per Cent Absorption (24 Hrs. Soaking)	C'mpr'ssive Str'ngth (lbs./Sq.in.)
1	23¼	52	......
2	23½	....	118
3	23¾	....	105
4	24½	....	103
5	23	54	......
6	24½	....	117
7	24½	....	91
8	25	....	110

Blocks Nos. 7 and 8 had an addition of 5% alum by weight of the lime. Test specimens prepared from commercial lime and my quick setting lime and tested under the same conditions gave the following results:

Material	Tensile Strength (lbs. per sq. in.) 3 Hrs.	14 Days	28 Days
Commercial lime	*0	7	21
Quick setting lime	7	43	46

*Specimen not set in 3 hours.

In three hours, the commercial lime had not set. My quick setting lime set, hardened and developed a material tensile strength in the same time-period. As far as I am aware, I am the first to prepare a quick setting lime product composed entirely of lime ingredients, quicklime and lime hydrate and in addition, possessing the property of expanding on quickly setting to develop a reasonable tensile strength.

When it is desired to retard the setting of the lime, retarders, such as glue, gum arabic, casein and sugar may be added.

It is quite obvious that in special cases small amounts of portland cement or gypsum may be added.

Hints and Helps for Superintendents

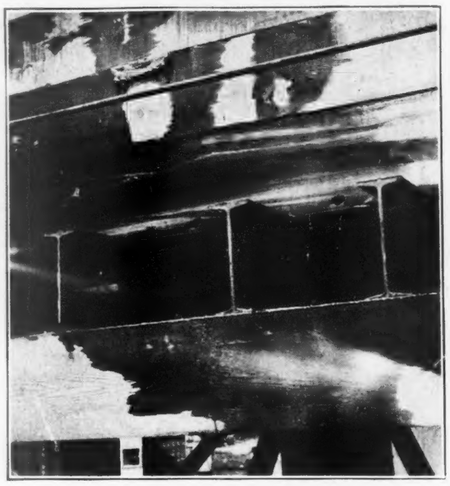
Composite Design of Bin

THE difficult point in designing a timber bin is to support the bottom, where there is a considerable span to be bridged so that trucks or railroad cars may pass underneath. The great weight calls for very large timbers in order to have sufficient strength to resist bending and shear. Care has also to be taken that there is sufficient bearing surface on the lower side of these bottom timbers so that the posts are not forced into them by the weight. Bins have often been thrown out of line in this way.

These difficulties may be met by building the bottom of the bin of some other material than wood. At present reinforced concrete is largely used for both the bin bottom and the supporting columns. But where concrete is not used for any other part of the plant (except perhaps for small footings for posts) the construction shown in the cut may be cheaper.

The bin bottom is laid on steel I-beams. A timber stringer runs under the ends of these beams on both sides of the bin and the posts are placed under this stringer and are made large enough so that they will not crush the fibers of the stringer. In this case, where a 16-ft. span had to be bridged, the lightest weight of 12-in. I-beams was found sufficient and the beams were set 16 in. apart.

The builders of this bin figured that the bottom cost less than one-half of what the cost of timber construction would have been.



Steel I-beams support bin bottom

Preventing Slurry from Pugging Up in Rotary Kilns

By WALTER J. PITT
Maria Island, Tasmania (Australia)

THE ingenious innovation described herewith has proved itself highly satisfactory from all points of argument. From time to time the chief trouble with a modern rotary kiln in a wet process cement plant is the persistent pugging up of the slurry at the feed end. It might occur at any time or any hour without warning, whether it be day or night shift, and often attended with serious accidents to employees. On one occasion the slurry pugged up into a stiff mass, causing an obstruction to the feed slurry entering the kiln. The inevitable was the result; boiling slurry poured over and found its way into the flue chamber, then under the damper plate, and finally formed itself into a boiling pool at the base of the kiln stack.

When this hazard occurs slurry feed is cut off, coal feeds disengaged, and the kiln is then allowed to cool down sufficiently to permit workmen entering with pick axes and shovels to clear the obstructing mass.

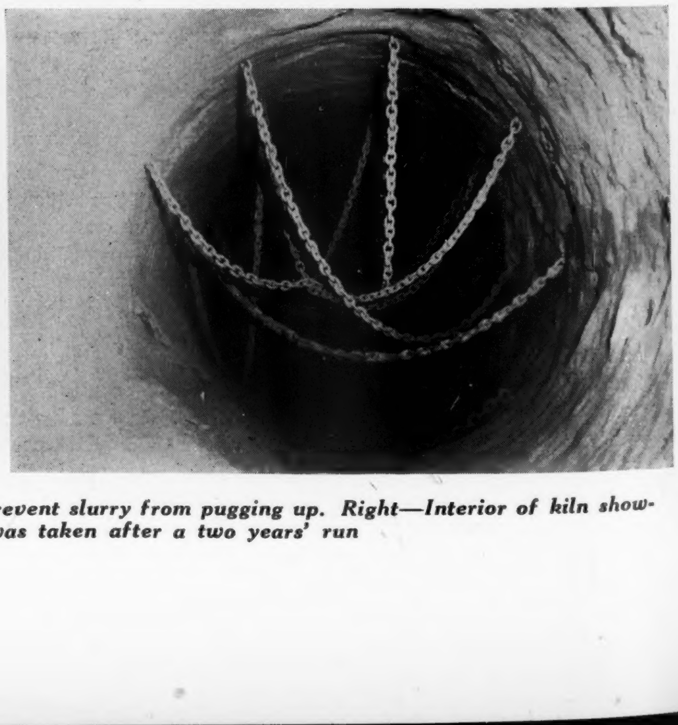
The following simple device is made up of junk chains salvaged from the scrap heap and has been rendering good efficient service for two years; has never given trouble since its inception, keeps the feed pipe clear to admit of an easy passage for the slurry entering the kiln. Moisture is maintained between 38% and 39%.

Holes are drilled in the shell of the kiln to take ¾-in. anchor bolts for permanently holding down the separate ends of the chains. There are 4 rows of holes to be drilled longitudinally, 2 ft. apart, extending from 10 ft. to 21 ft., depending on the length of kiln. A rotary kiln 150 ft. long would require 21 ft. of holes spaced at 2 ft. It would be found most convenient to work on the outside of the kiln whilst carrying out the boring work. The "anchor" bolt is first passed through the end link of each chain, next a box sleeve fits over bolt shank pushed up home, then inserted through lining bricks and shell of kiln and tightened up with nut on the outside of shell. It is impossible for the chain to work loose. The chains cross each other in the manner of a festoon (see illustration), so that when the kiln is in motion they repose alternately on the lining wall and automatically clean down adhering slurry, and allowing it to gravitate down the kiln to the burning zone. The following formula will give the spacing distances between bolts on the circumference of kiln shell. Let

$a =$ circumference of kiln in feet or meters.
$b = 4$, which is a constant.
$2c =$ distance between bolts.
Then $2c = a \div b$.

Example. Suppose the circumference of kiln to be 25.13 ft., then the spacing distance would be $25.13 \div 4 = 6.28$ ft.

You would have four rows of bolts equidistantly spaced at 6.28 ft. laterally. The wear and tear on the chains—infinitesimal and unaffected by the back heat, which is between 425 and 450 deg. C.



Left—End view of rotary kiln in which chains were used to prevent slurry from pugging up. Right—Interior of kiln showing chains in place—the picture was taken after a two years' run

Quarry-Track Kinks

AT the Lynn Sand and Stone Co quarry, Swampscott, Mass., they have made several short cuts in tracklaying. Two 4-ton Milwaukee gasoline locomotives are used for moving cars having capacities of 7⅓ and 8 tons. The 7⅓-ton quarry cars are unique in that they stand about 7 ft. high on 3-ft. gage tracks. However, because they have spring trucks, they ride comparatively rough track without tipping over.

Tracklaying has been much facilitated by using the locomotives to transport the rails. For this purpose a chain and hook are attached to the front of the locomotive. As illustrated in one of the views the locomotives drag the rails to their new location.

No wood cross-ties are used. The base of the rail is laid on the roughly-leveled crushed stone roadbeds, and steel clamps and tie-rods hold them to the gage. The clamps are placed about every 3 ft., and are quickly released when it is desired to take up the rails and move them to a new location.

The clamps, or ties, are made of a single bar with turned over edges, which lap the outside base of the rail, and two removable clamps which fit over the inside base of the rail. These clamps are attached to the tie piece below by a pin or pivot. They are clamped in position on the rail with a single bolt each. By removing these bolts the clamp can be swung around and the whole device readily removed.

The president of the Lynn Sand and Stone Co. is J. H. Cooke; W. D. Manchester is superintendent; P. C. Cooke is quarry superintendent.

Improvements in Quarry Drainage

WATER SEEPAGE into quarries is very costly and troublesome, particularly in northern localities, states the Bureau of Mines, Department of Commerce, in Serial 2766, recently issued. In summer time the expense of pumping may be high, and in winter there is difficulty, danger and additional expense through accumulation of ice. Water running over quarry walls and ledges forms sheets and columns of ice that are a menace to safety and are costly to remove. Flowing and dripping water also makes working conditions disagreeable.

Lately a great improvement in such conditions has been accomplished by a new method of drainage. In a carefully selected position outside the quarry some distance back from the face in the direction from which the water naturally flows toward the quarry, a 6-in. well-drill hole is sunk to such a depth that it pierces the water-carrying beds. Charges of dynamite are then fired in the hole in or near the water-bearing strata. Thus the rock is so fractured that water may readily flow to the drill hole. A pump is then installed to remove the water from the hole. Thus the drill hole taps the joints and seams through which the water travels, and intercepts the flow before it reaches the quarry face. The system is in successful operation at a slate quarry at Pen Argyl, Penn., the flow of water over the quarry face being reduced to a mere fraction of its former volume. This system is about to be adopted in other quarries.

Locomotive dragging rails to location. Note chain and hook attachment on the front

Tracks are laid on roughly-leveled crushed stone beds

Steel clamps and tie-rods are used to hold rails to proper gage

Quarry of the Gopher Stone Co., Minneapolis, Minn.

National Crushed Stone Officials Having Successful Western Trip

Journey from Madison, Wis., to Portland, Ore., Full of Interesting Meetings and Personal Contacts

By Nathan C. Rockwood
Editor-Manager, Rock Products

PORTLAND, Ore., Nov. 19.—This is the first breathing spell I have had in nearly two weeks of strenuous traveling as an unofficial member of the National Crushed Stone Association's party, consisting of President O. M. Graves, vice-president and general manager of the General Crushed Stone Co., Easton, Penn.; A. T. Goldbeck, director of the bureau of engineering, and J. R. Boyd, secretary of the association, Washington, D. C. During the period since November 8, 8 a. m., when we left Chicago, meetings have been held at Madison, Wis.; St. Paul, Minn.; Omaha, Neb.; Cheyenne, Wyo.; Salt Lake City, Utah, and Portland, Ore.

In general, of course, the meetings have been of a similar character, and it would require much repetition to report each one in detail. At all the meetings there have been crushed-stone producers, highway officials, engineers, contractors, sand and gravel producers, public officials and interested business men. At all the meetings President Graves has made a clear, concise and eloquent plea for the National Crushed Stone Association, explaining in detail its growth, its finances, its aims, its purposes and the need of greater income to develop some of its immediate aims.

Those who know President Graves, and appreciate the ease and forcefulness with which he speaks extemporaneously, do not need to be reminded that he has no set speech for these occasions, but in every case admirably adjusts his talk to the particular things the majority of the audience may be most interested in. All of the meetings have been very informal. A group has frequently sat about a table, or in a hotel or club room and freely discussed all manner of things in connection with the production and sale of crushed stone. On this account the trip has been a great education and a great inspiration to all the party, notwithstanding the apparent monotony of repetition.

A Great Industry

President Graves' addresses are along such general lines as the following: The party is on a western trip to bring to crushed-stone producers the need of the present national organization. This organization, which two years ago consisted of little but a name, with an annual income of $8000 a year, is now spending an annual income of about $40,000 a year very effectively in behalf of the crushed-stone industry. As an industry producing annually 100,000,000 tons of stone, valued at about $100,000,000, and with an invested capital estimated at $250,000,000, President Graves believes the National Association should have an annual income of about $100,000.

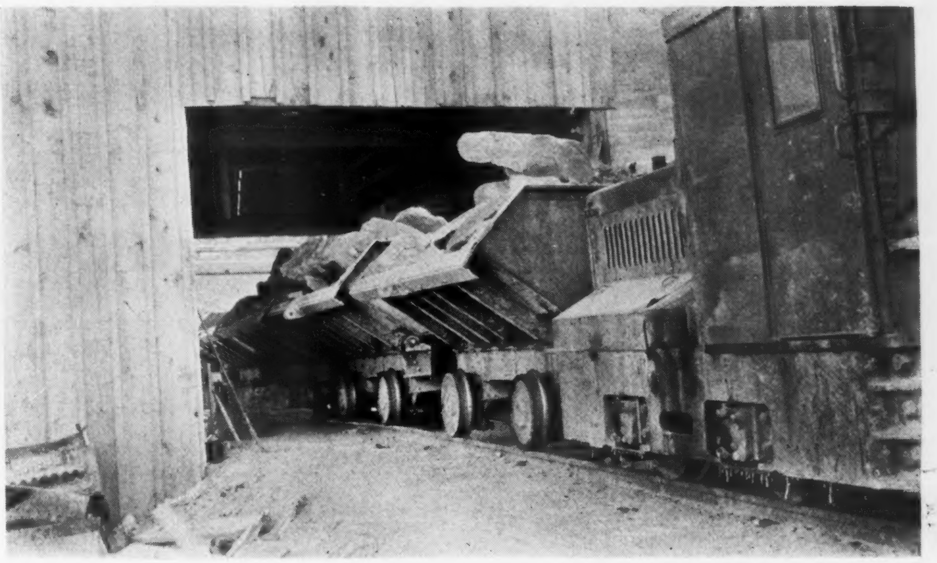
To support the present organization and work of the National Association requires about $36,000 to $38,000 a year. In order to utilize the services of A. T. Goldbeck, director of the bureau of engineering of the association, to the best advantage it is desirable that the association supply Mr. Goldbeck with a laboratory, and a laboratory assistant, so that he may initiate certain lines of research work. Mr. Goldbeck is one of the best known research engineers on highway materials in the world; as chief of the division of tests of the U. S. Bureau of Public Roads he was in charge of a very extensive laboratory and a laboratory organization of 70 or 80 men.

In order to interest state highway laboratories and other research organizations in certain lines of research it is very desirable, according to President Graves, for Mr. Goldbeck to initiate certain investigations of aggregates. To finance a laboratory and an assistant will require in the neighborhood of $20,000 a year additional, and it is partly in pursuit of this additional income

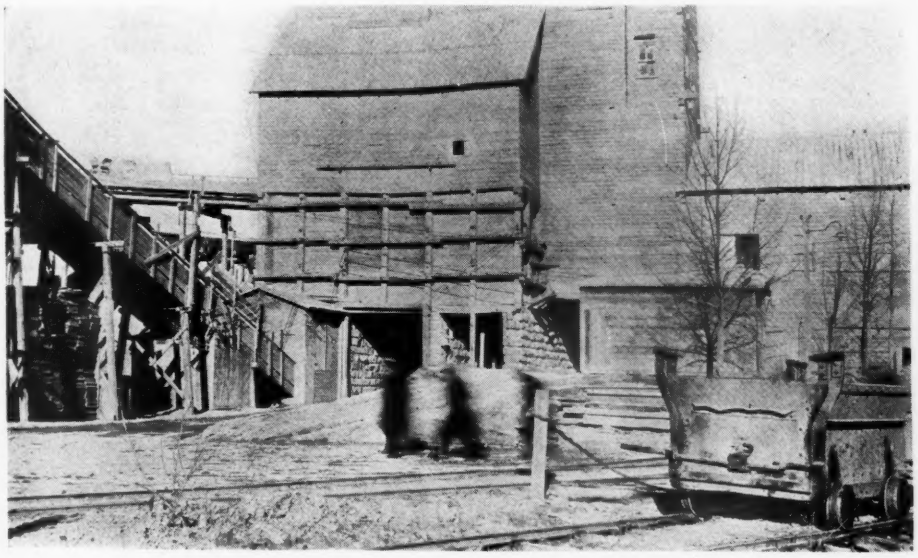
that the National Crushed Stone Association party is making this trip through the western and southern two-thirds of the United States. Practically the entire support of the association at the present time comes from the eastern part of the country.

In all of his talks, in whatever company, President Graves has made it clear that it was not the purpose of Mr. Goldbeck's work nor the aim of the National Crushed Stone Association to adopt any such slogan as "stone is the best by every test," nor to make any claims for the superiority of crushed stone not justified by research which would convince any engineer. He recognizes that the matter of the selection of aggregates for construction work is an economic and an engineering problem; all types of aggregates have their special qualities and their limitations. It is the purpose of the association to discover these qualities and these limitations and to utilize the data so developed for the benefit of the construction industry.

President Graves is sincere in his belief that the competition between gravel and crushed stone, and slag and crushed stone, will be on a fairer and cleaner basis when producers of these materials come to a better knowledge and a better understanding of their particular materials, and of their competitors' materials. Thus the present and proposed activities of the three national associations cannot but result in ultimate advantage to all, not to mention the construction industry and the engineering profession.



All-steel quarry cars at Gopher Stone Co.'s plant



Crushing plant of J. L. Shiely Co., St. Paul, Minn.

Supplementing President Graves talks, A. T. Goldbeck, director of the bureau of engineering of the National Crushed Stone Association, in each instance discussed in more detail just what lines of research he thought would be productive of the most good to the crushed-stone industry. Stated briefly, this research would tend to overcome the handicap that crushed-stone aggregate has in most instances in the matter of yield of finished concrete, and tend to develop the possible special virtues of crushed stone aggregate in giving a concrete of greater tensile strength than gravel concrete.

In the matter of yield of concrete, a crushed stone aggregate, because of its irregular shaped fragments, has a larger percentage of voids than a gravel aggregate. This may be overcome by a more careful grading of crushed-stone aggregate than is ordinary practice either at the crushing plant or in engineers' specifications. Also a crushed stone aggregate may be made to give the same yield as a gravel aggregate by increasing the proportion of sand, so that the voids are filled with mortar. This also increases the workability of crushed-stone concrete, a very practical consideration.

Mr. Goldbeck contends that most concrete is undersanded, because account is not taken of the bulking of moist sand. This naturally is more of a handicap to crushed-stone concrete than to gravel concrete. Much of the most effective work he has done for the association has been in bringing this fact to the attention of engineers and contractors. An undersanded crushed stone aggregate also has the disadvantage of being harder

National Crushed Stone Association party at Gopher Stone Co.'s plant. J. L. Shiely at extreme left, John Wunder in center

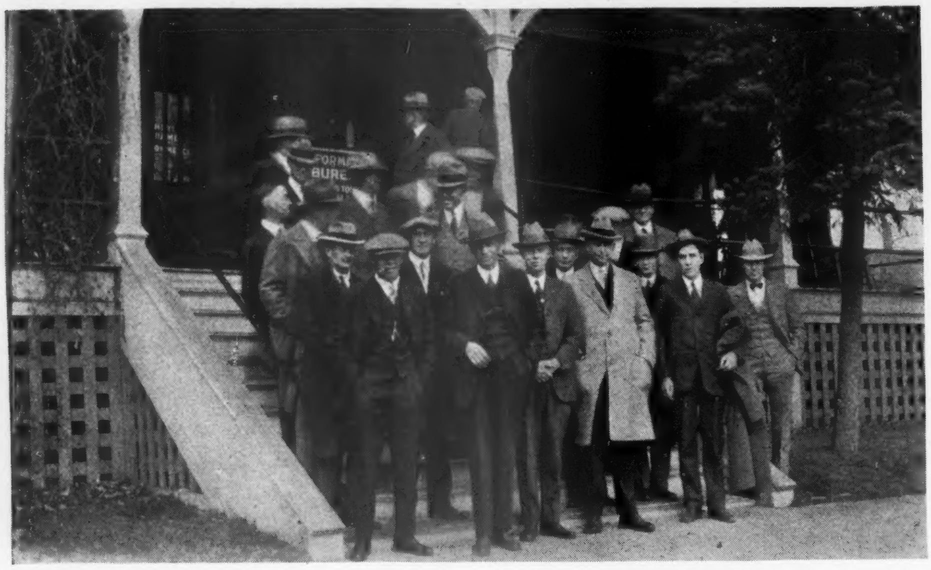
working than a gravel concrete of the same consistency.

Mr. Goldbeck also contends that crushed-stone aggregate may carry a larger proportion of sand than a gravel aggregate because a crushed-stone concrete has greater tensile strength than a gravel concrete, all other things being equal. If this is true, it benefits the stone producer in several ways: It permits enough sand to be added to a crushed stone aggregate to adequately fill the voids and give the same yield of concrete as a gravel aggregate and a concrete of equal tensile strength; or if the proportions of sand and coarse aggregate are constant in both cases a thinner slab of stone concrete will be equal in strength to a similar slab of gravel concrete.

Concrete pavements, Mr. Goldbeck says, do not fail from compression, but from cross-bending or tension. Yet practically all comparative tests of concrete made from various aggregates are based on the compressive strengths of the test specimens. There is not necessarily any relation between the compressive and the tensile strengths of concrete. Hence a fairer test to judge concrete is a comparison of tensile strengths.

Of course, practically all the foregoing relates to the use of crushed stone as a concrete aggregate. This trip has demonstrated that this is *the live issue* in nearly every locality. In most of the western territory thus visited, and in a good part of that remaining to be visited, the crushed stone aggregate is produced to supplement a shortage of gravel aggregate, or to fill a specific demand for a crushed aggregate, the difference being clearly recognized, defined and accepted by the gravel producer, who is also usually the crushed-stone producer as well. Also, in general, there is not much difference in recognition of a crushed material that comes from a gravel pit and one that comes from a quarry.

Mr. Goldbeck has also discussed his activities in the improvement of design of highway pavements of both macadam and concrete types. He has told of the possibilities of developing markets for what are now, in many cases, waste products; he has discussed the desirability of an engineering study of quarry operation and quarry cost analyses. He has been asked many questions by highway officials and engineers, who have everywhere recognized him as an outstanding authority on road design, construction and materials.



The party in front of Chamber of Commerce building, Cheyenne, Wyo., with C. J. Cunningham and S. Cunningham (front row, left)

Secretary J. R. Boyd, of the National Crushed Stone Association, has done his "turn" well and effectively by telling of the activities of his office in the matter of transportation service and contacting with various government bureaus. He has told about the plans and prospects for the coming annual convention of the association in January at Detroit.

For the first three meetings, W. R. Sanborn, regional vice-president of the National Crushed Stone Association, president of the Lehigh Stone Co., Kankakee, Ill., was a member of the party, and spoke particularly of the National Association's part in the recent railway rate hearings, and of the possibilities of winter operation and winter construction work.

The writer has seldom escaped being called upon for some remarks. These have invariably been a brief statement in justification of the trip as a means of increasing the membership of the National Crushed Stone Association, in making for a better understanding between the gravel and the crushed-stone industries, thus leading to better competitive conditions, not merely among crushed-stone producers, but as between crushed-stone producers and gravel producers. Rock Products has always lent its very best and most earnest efforts to bringing about "peace and goodwill" among its readers and this trip is demonstrating far beyond the immediate expectations of the writer the essential unity of these two great competitive branches of the rock products industry.

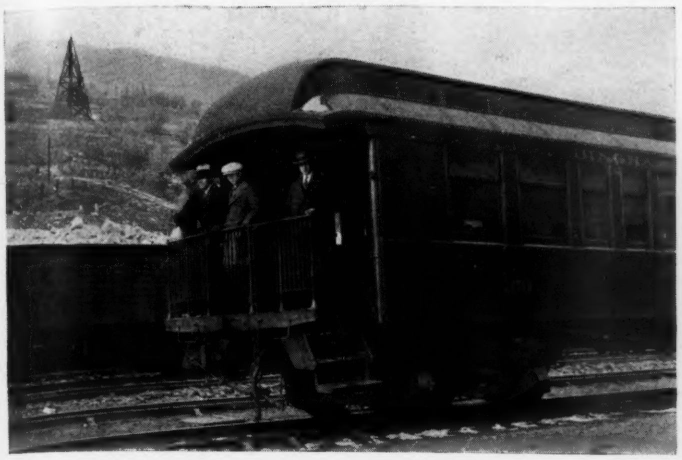
It has been nothing short of stimulating and inspiring to see the open-handedness and frankness with which the National Crushed Stone Association officials have laid their cards on the table among groups of producers, which is already stated, have in every instance included men whose interests were at least equally as much centered in the gravel industry as in the quarry industry. If this spirit prevails between these two divisions of the aggregate industry there certainly must come prosperity to both groups.

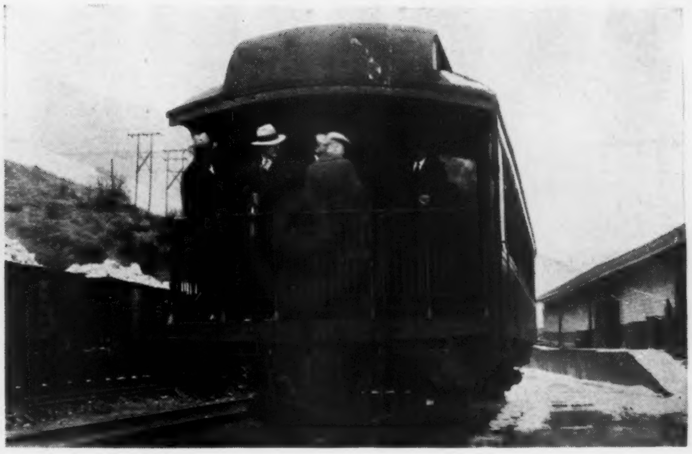
At Salt Lake City, Utah, with Eric Ryberg (extreme left)

Madison, Wis.

Supplementing the foregoing summary of the trip to date, I will briefly touch on the various individual meetings and list the men who attended them (exclusive of the members of the party).

The first stop on the trip was made at





Two views of the private car, "Business," of the general manager of the Utah Copper Co. in which the N. C. S. A. party made a trip to the famous Bingham Canyon copper mines

Madison, as this is the capital of the state, which made it possible to visit the state highway laboratories and become acquainted with some of the state highway officials. The luncheon and meeting, at the Hotel Loraine, was in charge of A. J. Blair, past president of the National Crushed Stone Association, vice-president and general manager of the Lakeshore Stone Co., Milwaukee, Wis. Addresses were made by each member of the party, by Mr. Blair, by G. D. Rose, president of the Dubuque Stone Products Co., Dubuque, Iowa, and by R. W. Scherer, former secretary of the Wisconsin Crushed Stone Association.

Mr. Rose, who is a prominent building supply dealer in Dubuque, Iowa, enthusiastically endorsed trade associations in general, and the program of the National Crushed Stone Association in particular. He has recently acquired an old quarry at Dubuque and is building a new 1500-ton a day crushing plant. Mr. Rose was very optimistic regarding the future of the quarry business in Iowa.

The Wisconsin crushed-stone producers present were inclined to take a rather pessimistic point of view. Local gravel-pit competition is their chief problem, as it is also the problem of the commercial sand and gravel producer. Those present were:

T. E. Fleischer, Sheboygan Lime Co., Sheboygan, Wis.
Edwin Daane, Sheboygan Lime Co., Sheboygan, Wis.
M. Kimmer, Sheboygan Lime Co., Sheboygan, Wis.
A. Hintz, Sheboygan Lime Co., Sheboygan, Wis.
W. R. Kowalhe, Sheboygan Lime Co., Sheboygan, Wis.
M. O. Withey, University of Wisconsin, Madison, Wis.
C. F. Daggett, secretary, Wisconsin Mineral Aggregate Association, Milwaukee, Wis.
W. A. Pierce, city engineer's office, Madison, Wis.
M. M. Isabella, maintenance engineer, Wisconsin State Highway Department, Madison, Wis.
M. W. Deutsch, North Shore Materials Co., Racine, Wis.
H. E. Payne, Consumers' Co., Chicago, Ill.
T. J. Vitcenda, materials engineer, Wisconsin State Highway Department, Madison, Wis.
W. R. Marregold, Marregold Stone Co., Milwaukee, Wis.
P. M. Nauman, Dubuque Stone Products Co., Dubuque, Iowa.
R. W. Lutz, Lutz Stone Co., Oshkosh, Wis.
G. D. Rose, Dubuque Stone Products Co., Dubuque, Iowa.
R. J. Brodhead, Hercules Powder Co., Milwaukee, Wis.
R. W. Scherer, Western Lime and Cement Co., Milwaukee, Wis.
R. C. Robertson, Western Lime and Cement Co., Milwaukee, Wis.
Geo. F. Hammerschmidt, Elmhurst-Chicago Stone Co., Elmhurst, Ill.
E. L. Gates, superintendent of highways, Du Page County, Illinois.
P. D. Southworth, secretary, Wisconsin Agricultural Limestone Association.
C. G. Ruederbusch, Mayville White Lime Works, Mayville, Wis.
K. C. Ruederbusch, Mayville White Lime Works, Mayville, Wis.
R. Hammerschmidt, Elmhurst-Chicago Stone Co., Elmhurst, Ill.
J. Pickens, Pickens Engineering Co., Milwaukee, Wis.
Geo. S. Nicholson, Manistique Lime and Stone Co., Manistique, Mich.
G. W. Hughes, Manistique Lime and Stone Co., Manistique, Mich.
V. M. Weeks, E. I. du Pont de Nemours and Co., Milwaukee, Wis.
G. C. Wolf, Waukesha Lime and Stone Co., Waukesha, Wis.
E. F. Brenner, Waukesha Lime and Stone Co., Waukesha, Wis.
W. R. Sanborn, Lehigh Stone Co., Kankakee, Ill.

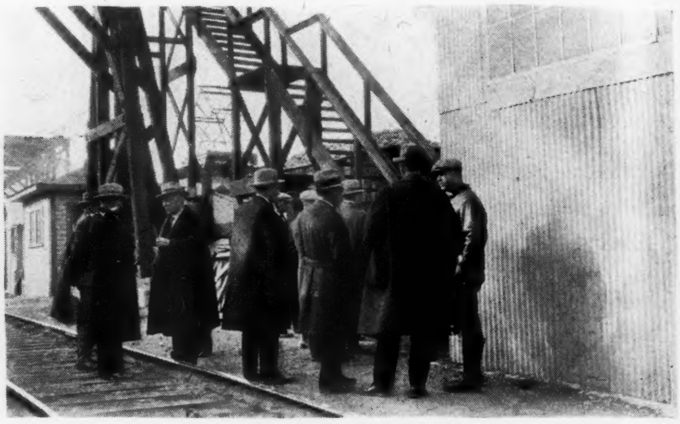
St. Paul Meeting

At St. Paul, Minn., on November 9 the members of the party were the guests of J. L. Shiely, president of the J. L. Shiely Co., and John Wunder, of Minneapolis, at the Minnesota Club. Incidentally, visits were made to one of John Wunder's quarry plants, the Gopher Stone Co., Minneapolis, and to the J. L. Shiely Co. quarry plant in

At one of the electric shovels on a higher level of the Bingham Canyon mine

President Graves has his picture taken with one of the big shovels

Party returning to the car after visiting Bingham Canyon mine



Going through the Magna crushing plant and mill of the Utah Copper Co.

St. Paul. The trip to and between the two plants included many of the notable attractions of the twin cities.

These two quarry plants were of particular interest to the visitors because of the shallow ledges quarried, and because they are in thickly populated cities, where there are problems of blasting without unnecessary nuisance to neighbors.

The afternoon meeting at the Minnesota Club developed much interesting information in regard to the aggregate situation of the twin cities. Here crushed stone is quite essential to supplement the gravel supply, irrespective of all other considerations. Those present were:

C. D. Brewer, Duluth Crushed Stone Co., Duluth, Minn.
Fred Klass, General Electric Co., Minneapolis.
J. E. Dickey, E. I. du Pont de Nemours and Co., Minneapolis.
Harper Schaffer, Luverne, Minn.
P. A. Schroeder, Gopher Stone Co., Minneapolis.
E. C. Lemieux, Gopher Stone Co., Minneapolis.
John Wunder, Minneapolis.
J. L. Shiely, J. L. Shiely Co., St. Paul.
T. H. Johnson, consulting engineer, Sioux City, Iowa.
W. R. Sanborn, Kankakee, Ill.

Omaha Meeting

Another night in a Pullman berth and we arrived in Omaha, Neb., where Thomas Sullivan had arranged a meeting at the Hotel Fontenelle. This meeting was of particular interest, as the foremost quarry men of Iowa were present, and there was a thorough-going discussion of the crushed-stone situation in that state. Those present were:

Party at Bingham Canyon. (1) E. H. H. Simmons, president New York Stock Exchange. (2) A. T. Goldbeck, chief of bureau of engineering N. C. S. A. (3) Eric Ryberg of Utah Sand and Gravel Products Co. (4) Harry S. Jacobs, well known Salt Lake City mining man

J. F. Schroeder, Linwood Cement Co., Davenport, Iowa.
Thos. J. Lough, U. S. Bureau of Public Roads, Omaha.
Thos. Sullivan, Omaha.
Stanley M. Hands, River Products Co., Iowa City, Iowa.
J. M. Ferguson, Hercules Powder Co., Omaha.
Fred Johnson, Kansas City Quarries Co., Kansas City, Mo.
R. C. Fletcher, Iowa Limestone Products Co., Des Moines, Iowa.
W. R. Sanborn, Kankakee, Ill.

The Iowa situation is improving. There are prospects of extensive hard-road building by the counties. The demand for agricultural limestone has been good. The situation at Kansas City is rather discouraging, as there are a considerable number of small quarries scattered about the city and the

Secretary J. R. Boyd is interested in the car dumpers at the Magna plant

Part of the famous Bingham Canyon mine of the Utah Copper Co., where 100,000 tons is quarried per day

competitive conditions were stated to be about "the worst ever."

Cheyenne Meeting

In spite of the fact that there are but one or two commercial crushed stone operators in the entire state of Wyoming, the party's welcome at Cheyenne on Armistice day, November 11, was one of the most cordial. We were shown the city, the fort (Russell) and some of the concrete paving done under the auspices of the state highway department. Then followed a luncheon by the Chamber of Commerce and a meeting in which a large percentage of the city's engineering fraternity participated.

S. Cunningham and C. J. Cunningham, of S. Cunningham and Son, Horse Creek, Wyo., were the quarry men responsible for this reception. They are large producers of high grade limestone for beet sugar refineries. There is as yet little demand for crushed stone for other purposes in Wyoming, as there are but a few miles of concrete paving in the entire state. Many miles of highway are improved with local gravels, however.

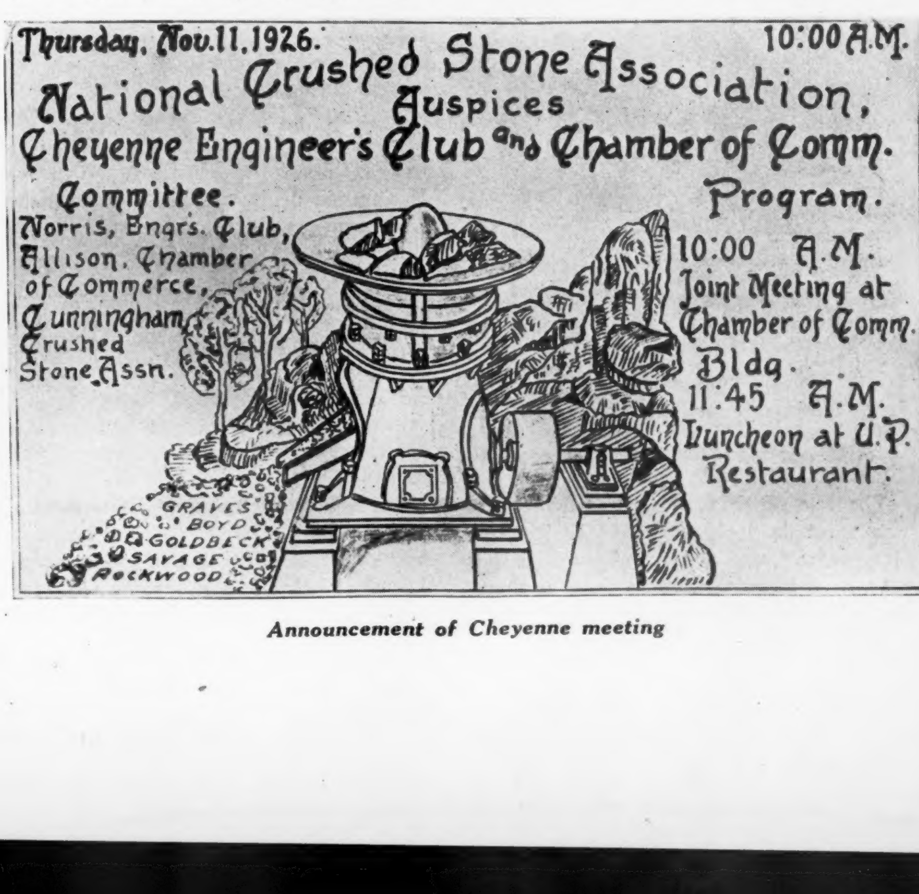
W. A. Norris, of the Wyoming state highway department, served as chairman of the meeting, which was most interesting from the light it shed upon the highway conditions and prospects in one of our typical Rocky Mountain states. Those present were:

Marvin J. Little, U. S. government engineer.
Geo. L. Sherard, Cheyenne.
F. H. Allyn, Wyoming State Highway Department.
C. J. Cunningham, S. Cunningham and Son, Horse Creek, Wyo.
S. Cunningham, S. Cunningham and Son, Horse Creek, Wyo.
Archie Allison, contractor, Cheyenne.
O. H. Read, O. H. Read Co., Omaha, Neb.
John T. Richards, Cheyenne.
W. W. Russell, Cheyenne.
Wm. Dubois, Cheyenne.
H. Ambrose Kiehl, civil engineer and superintendent Q. M. C., Fort D. A. Russell.
L. E. Jensen, Wyoming State Highway Department.
Albert B. Bartlett, state geologist.
Clyde W. Atherby, Cheyenne.
J. A. Naret, U. S. General Land Office.
Z. E. Sevison, state highway engineer.
Henry Lloyd, Cheyenne.
Earl Lloyd, state engineer's office.
C. C. Warrington, state highway department.
W. A. Norris, state highway department.
T. P. Fox, Union Pacific R. R., Cheyenne.

The Cheyenne engineers were royal hosts, and the four hours spent in that hospitable city will be remembered by all the party, each of whom, incidentally, can lay some claims to being an engineer.

Salt Lake City Meeting

The evening meeting scheduled for Denver, Colo., was abandoned for lack of a single interested producer. However, this being the first occasion since leaving Chicago for spending the night in a real bed, the overnight stop at Denver was much appreciated, and an early start was made the next morning for Salt Lake City.



Announcement of Cheyenne meeting

Eric Ryberg, of the Utah Sand and Gravel Products Co., was on hand at the station to greet the party on its arrival, and for the following two and a half days he saw to it that every one of his city's Crushed Stone Association guests was well taken care of. A meeting was held on Saturday afternoon, November 13, at the Chamber of Commerce and Commercial Club. Mr. Ryberg presided and the following were present:

J. B. Maher, Union Portland Cement Co.
F. H. Richardson, Portland Cement Association.
H. D. Landes, construction machinery.
B. A. Searle, engineer.
Preston Peterson, member, Utah Highway Commission.
Levi Muir, testing engineer, Utah Highway Commission.
Frank W. Maher, Ideal Sand and Gravel Co.
H. Petersen, Hercules Powder Co.
F. J. McGanney, Hercules Powder Co.

On Sunday, November 14, through the kind offices of Mr. Ryberg, the National Crushed Stone Association party joined a party of prominent Salt Lake City mining men and brokers, who with E. H. H. Simmons, president of the New York Stock Exchange, as their principal guests, were inspecting the famous Utah Copper Co. mine in Bingham Canyon. The entire group were the guests of the general manager of the company on his private car "Business" and were taken over every level of this famous open-cut mine.

This is the largest quarrying operation in the world. Some 27 shovels on as many levels move about 100,000 tons of material a day, of which about half is waste rock, or stripping, and the other half copper-bearing ore averaging about 1% metal. Marion electric shovels are replacing the older steam shovels.

Those who composed this inspection party (in addition to Messrs. Graves, Goldbeck, Boyd and the writer) were:

E. H. H. Simmons, president, New York Stock Exchange, New York City.
S. F. Streit, president of the Stock Exchange Clearing House Association, New York City.
W. D. Nebeker, Salt Lake City.
W. H. Child, Salt Lake City.
J. A. Barclay, Salt Lake City.
W. J. Snyder, Salt Lake City.
L. D. Mortensen, Utah Sand and Gravel Products Co., Salt Lake City.
John C. Lynch, Salt Lake City.
F. J. McGanney, Salt Lake City.
Ernest Bamberger, Salt Lake City.
John D. Stack, Salt Lake City.
Harry S. Joseph, Salt Lake City.
Ivan H. Swanson, Jamestown, N. Y.
F. H. Richardson, Salt Lake City (P.C.A.).
Frank Maher, Ideal Sand and Gravel Co., Salt Lake City.
James J. Burke, Salt Lake City.
H. C. Hicks, director, Utah Securities Commission.
Eric Ryberg, Utah Sand and Gravel Products Co., Salt Lake City.

The rest of the stay in Salt Lake City was spent in looking over Mr. Ryberg's plant—now a sand and gravel operation, but soon to become a rather unique combination of a sand and gravel pit and a quarry, and in visiting other points of interest.

From Salt Lake City we came direct to Portland, where we are at this writing. In the next issue of Rock Products we will try to bring the narrative of the expedition to the latest possible date.

It is the unanimous opinion of the members of the expedition that much good is being accomplished for the industry and the association; and it is fervently hoped that many of the friends and acquaintances we are making will come east next January to the Detroit convention and give us an opportunity to introduce them to some of our eastern friends.

Two Speakers Announced for Crushed Stone Convention

MR. HENRY WOLF BIKLE, general attorney of the Pennsylvania railroad, and Mr. A. J. Brosseau, president, Mack Trucks, Inc., will give addresses at the banquet to be held during the convention of the National Crushed Stone Association in Detroit, January 19. This announcement has just been issued from National Crushed Stone Association headquarters. There will also be two other speakers, it is stated, but they have not been determined as yet.

Road Show to Be International This Year

TWENTY all Latin-American nations have been invited to participate in the 1927 Road Congress to be held in Chicago during Good Roads Week, January 10 to 15. The meeting is to be the 24th annual convention and road show of the American Road Builders' Association.

Invitations were extended presidents of all South American republics to appoint official delegates to the convention. The foreign delegates will be honored with a Pan-American day, according to H. G. Shirley, president of the association.

"The increasing interest of the Latin-American countries in the building of roads has made it essential that representatives of these nations assemble in such a meeting as the American Road Builders' Association has called for Good Roads Week," Mr. Shirley said. "During that period the visitors may absorb the better points of highway development in this country and apply them to construction in their own land."

A New Market for Sand

PEACE again reigns in the little colony of animals in the zoo at Breckenridge park, San Antonio, Texas. In his office, Park Commissioner Ray Lambert sighs a sigh of relief and turns to other duties. Another problem has been solved. Another tenant has been satisfied.

For some time this city has been seeking a special kind of sand to tickle the palates of the ostriches of this zoo. Whether this delicacy is served with the drinks, after meals or only on special occasions could not be learned, but that it had an important place in the diets of these birds was evident by the frantic efforts put forth in search of this commodity.

At last a bed was found which appeared to have the right flavor. It was neither too tough nor too hard. Nature had done it to a fare-you-well, and the surly bipeds of the zoo accepted it with considerable enthusiasm. Several loads have been delivered. Others will be brought in from time to time as required. Which only goes to prove that there are hundreds of uses for good products if one only knows about them. Possibly this new field will help you boost your sales volume during the coming year.

Missouri Valley Producers to Meet December 13 and 14

THE annual meeting of the Missouri Valley Association of Sand and Gravel Producers will be held at Kansas City, December 13 and 14. Requests for reservations and the like may be communicated to W. E. Johnson, secretary of the association, 301 Minor building, Kansas City, Mo.

The meetings of this association are always interesting and important to the industry as a whole and a full attendance is expected on this occasion.

South Dakota State Cement Plant Closes for Season

PRODUCTION of cement was halted recently at the South Dakota state-owned cement plant located at Rapid City, in accordance with the annual custom, with a total of 98,000 bbl. on hand for winter shipments. It is expected that the shutdown period will continue for three months.

The force has been cut down, but a crew has been retained to make necessary repairs.

Total shipments thus far during the year approximate 400,000 bbl., 75,000 more than were shipped in 1925.

The daily output of the South Dakota cement plant is 2000 bbl. It is a wet-process operation, using two 10x150-ft. kilns. Elmer C. Thorpe is secretary.—*Pierre (S. D.) Journal.*

New Insulating Material from Mica

A NEW insulating material known as Mycalex, has been developed by the General Electric Co., Schenectady, N. Y. Ground mica and lead borate make up the new product which is expected to find many uses in places where high frequency are encountered such as in radio work.

Mycalex, the manufacturers say, is softened by heating to a dull red and the plastic mass is then formed into the desired shape by compression in steel molds. An added advantage is said to be in the fact that metal parts can be combined with the insulator during the molding process. The material can be machined by the usual methods. Its electrical properties are stated to be superior to porcelain in many respects.

Drilling and Blasting Methods Adapted to Character of Rock

Practice of the United Verde Copper Company at Jerome, Arizona

ACCORDING to an article by C. E. Mills, chief engineer of the United Verde Copper Co., drilling and blasting methods in this company's open cut mine (which might just as well be called a quarry) are varied according to the character of the rock encountered in the various parts of the operation. As the rocks vary from soft oxidized quartz and chert to hard diorite, the comparison of methods and of costs, given in an article in the *Engineering and Mining Journal,* is interesting and valuable. In part the article says:

"No. 5 Keystone well drills, using 6- and 8-in. bits and 16-ft. stems, are used. The rate of drilling varies widely, depending both on character of ground and on the proficiency of the drill crew. Drilling speeds for the various classifications of ground are as follows: Oxide and oxidized quartz, 20 to 30 ft. per shift; schist and soft diorite, 10 to 15 ft.; fresh diorite and jasper, 3 to 5 ft. per shift. The average footage drilled per man-shift is 2.5 ft. in moderate ground and 0.75 ft. in hard diorite. This includes delays and time taken in moving. The drilling crew consists of a runner, one fireman and a coal boy.

"The location, spacing and depth of drill holes depends entirely on the height of bank and character of material. For medium ground, the allowable burden should never be less than 16 ft. for 20-ft. banks and 50 ft. for 100-ft. banks. The table gives common practice at the United Verde:

Spacing and Depth of Drill Holes

Height of bank, feet	Burden on hole, feet	Spacing of holes, feet
50	28 to 36	32 to 44
110	36 to 44	55 to 95
150	40 to 50	100 to 135

"The sub-grade or depth of bottom of hole below the floor of cut is usually 10% of the height of bank being drilled.

"In hard ground it is usually necessary to spring the hole three times to form a chamber of sufficient size to take the required charge of powder. In medium ground, twice is sufficient. The powder charge will vary from 600 lb. in 50-ft. holes to 8000 lb. in 150-ft. holes. In certain instances as high as 10,000 lb. of explosives have been used in one hole. The holes are sprung with 50% gelatin and electric detonators. The amount of powder used in springing will run as follows:

"First springing—1 to 1½% of total powder charge.

"Second springing—2½ to 3½% of total powder charge.

"Third springing—7 to 10% of total powder charge.

"Apache No. 1 Quarry Special bag powder is used in all dry holes, and 35% gelatin stick powder in wet holes. In the latter case, the sticks are cut into 2-in. lengths before dropping in the hole.

The primer is made up by placing one No. 8 electric detonator in one of several sticks of powder, which are tied together. The lead wires are attached to No. 14 insulated wire and lowered to the bottom of the hole. A string of Cordeau is next wrapped around six or eight sticks of powder and also placed in the hole. A portion of the powder charge is next loaded and another primer similar to the first one, already described, is placed near the top of the charge. The remainder of the charge is then placed and the hole tamped with sand or fine dirt. The Cordeau is then capped with a No. 8 detonator, all three lead wires are connected in parallel and the hole is shot, using 440 volts a.c. current. If more than one hole is shot at a time, all lead wires are connected in parallel and shot in the same manner.

"The powder is loaded into the hole by means of an inclined trough, which allows all loaders excepting the man handling the tamping stick to work at a distance from the collar of the hole. When a shattering action is desired, the hole is loaded up into the barrel; otherwise, the charge is confined to the chamber at the bottom. Jackhamer toe holes are occasionally used to relieve the toe of the bank in case the burden is excessive.

"The average cost of drilling holes is given as:

Cost of Drilling

Item	Cost per foot	Cost per shift
Labor	$2.54	$13.68
Fuel	1.15	6.19
Supplies	0.89	4.77
Repairs	1.37	7.50
Total	$5.95	$32.14

"Machine drilling has replaced churn-drill holes in the diorite because of the difference in drilling costs. In hard rock, a Leyner will average 3.7 ft. per hour, whereas a churn drill will average only 0.5 ft.

"Vertical holes are drilled from 10 to 15 ft. apart, depending on the ground. The depth will vary from 21 to 30 ft. and the burden from about 16 to 20 ft. Drilling speed will average 3.7 ft. per hour, or 12 ft. per man-shift, with a labor cost of $0.42 per foot. Powder charge will average 112 lb. per hole. The percentage of holes lost by caving and because of broken and stuck steel will run as high as 35%.

Toe holes are used in combination with the vertical Leyner holes and will average 18 ft. in depth. They are spaced from 6 to 15 ft. apart, depending on the character of the bank, and are drilled so that the bottom of the hole will be 2 or 3 ft. below grade.

Drilling speed will average 3.5 ft. per hour, or 17.3 ft. per man-shift, with a labor cost of $0.22 per foot. Powder charge will average 140 lb. per hole. The percentage of holes lost because of loose ground, broken steel and similar mishaps will average 20%.

"After a series of toe and vertical holes have been drilled, they are sprung with two or three sticks of powder in the bottom of the hole, then with six to ten sticks and again with 18 to 25 sticks. The chamber after the third springing is usually of sufficient size to hold the required amount of powder.

"Four to six sticks of 50% gelatin are then placed in the hole after inserting a No. 8 electric blasting cap in one of the sticks. The bag powder is then loaded by use of an air loading machine. The powder is delivered from the gun to the bottom of the hole through a brass tube which permits the air to escape without carrying along a portion of the charge. This loading device will handle 150 lb. of powder in three minutes, whereas formerly about 20 minutes was required to load a 50-lb. box of stick powder. This method applies only to toe holes, the vertical holes being loaded by use of a funnel. After the holes are all loaded, they are tamped with any fine dirt that is handy, connected in parallel, tested with an ohmmeter galvanometer and shot with 440 volts a.c. current.

"A comparison of the yardage, powder and labor costs of the two methods is:

Drilling Costs With Well Drills and Machines

	Well drilling	Machine drilling
Powder per cubic yard broken, pounds	0.386	0.398
Cubic yards per pound of powder	3.08	2.99
Cost of explosives per cubic yard broken	$0.062	$0.064
Direct labor cost per cubic yard	$0.078	$0.114

"Secondary blasting consists in breaking up the large boulders into sizes suitable for loading into dump cars or motor trucks. If this can be done without delaying the shovel, the oversize pieces are drilled and shot. This is called block-holing. Where the time element is of more importance than the cost of the powder used, the boulders are 'dobeyed'—that is, the powder is laid directly on the piece to be broken and covered with fine dirt and clay or mud. The powder consumption and cost per cubic yard broken for secondary blasting are $0.135 lb. and $0.029 respectively."

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co. (common)[2] new stock	Nov. 20	No par	38	40	1½% quar. Apr. 3
Alpha Portland Cement Co. (preferred)[2]	Nov. 23	100	115	....	1¾% quar. Mar. 1
Arundel Corporation (sand and gravel—new stock)	Nov. 22	No par	33½	33½	45c qu., 15c ext. July 1
Atlantic Gypsum Products Corp. (1st 6's carrying 10 sh. com.)[10]	Nov. 23	....	106	110	
Atlas Portland Cement Co. (common)[2]	Nov. 20	No par	41½	43	50c quar. Sept. 1
Atlas Portland Cement Co. (preferred)	....	100	....	....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[2]	Nov. 20	33⅓	43	....	2% quar. Oct. 1
Beaver Portland Cement Co. (1st Mort. 7's)[8]	July 29	100	100	100	
Bessemer Limestone and Cement Co. (common)[4]	Nov. 19	100	135	....	1½% quar. Oct. 1
Bessemer Limestone and Cement Co. (preferred)[4]	Nov. 19	100	107½	110	1¾% quar. Oct. 1
Bessemer Limestone and Cement Co. (convertible 8% notes)[4]	Nov. 19	100	99	100	8% annual
Boston Sand and Gravel Co. (common)[10]	Nov. 20	100	70	80	2% quar. July 1
Boston Sand and Gravel Co. (preferred)[10]	Oct. 23	....	90	95	1¾% quar. July 1
Boston Sand and Gravel Co. (1st preferred)[10]	Oct. 23	....	90	95	2% quar. July 1
Canada Cement Co., Ltd. (common)	Nov. 22	100	114½	114⅞	1½% quar. Oct. 16
Canada Cement Co., Ltd. (preferred)[11]	Nov. 19	100	116	116½	1¾% quar. Nov. 16
Canada Cement Co., Ltd. (1st 6's, 1929)[11]	Nov. 19	....	101¼	102½	/% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	Nov. 19	100	93	96	
Charles Warner Co. (lime, crushed stone, sand and gravel)	Nov. 17	No par	23	25	50c quar. July 12
Charles Warner Co. (preferred)	Nov. 17	100	101	104	1¾% quar. July 22
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[16]	Nov. 20	100	102½	103½	
Cleveland Stone Co. (new stock)	Nov. 22	....	60	....	$1.50 qu. Sept. 1
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	Nov. 19	100	104	....	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	Nov. 23	....	97	99	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	Nov. 23	100	96	99	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	Nov. 19	100	99½	101	
Dewey Portland Cement Co. (1st Mort. 6's)[30]	Nov. 23	100	99	100	
Dolese and Shepard Co. (crushed stone)[7]	Nov. 22	50	89	91	$1.50 quar. Oct. 1
Egyptian Portland Cement Co. (7% pfd. with com. stock purchase warrants)[21]	Sept. 24	....	96	100	1¾% quar. Oct. 1
Egyptian Portland Cement Co. (common)[21]	Sept. 24	....	14	18	40c quar. Oct. 1
Egyptian Portland Cement Co. (warrants)[21]	Sept. 24	....	10	15	
Giant Portland Cement Co. (common)[2]	Nov. 20	50	60	63	
Giant Portland Cement Co. (preferred)[25]	Nov. 20	50	50	55	3½% s.-a. June 15
Ideal Cement Co. (common)	Nov. 22	No par	67	69	$1 quar. July 1
Ideal Cement Co. (preferred)[6]	Nov. 20	100	106	109	1¾% quar. July 1
International Cement Corporation (common)	Nov. 22	No par	52½	52⅞	$1 quar. Dec. 31
International Cement Corporation (preferred)[2]	Nov. 22	100	103¾	103¾	1¾% quar. Dec. 31
Kelley Island Lime and Transport Co.	Nov. 22	100	129	133	$2 quar. Oct. 1
Lawrence Portland Cement Co.[2]	Nov. 23	100	90	100	2% quar.
Lehigh Portland Cement Co.[6]	Nov. 20	50	87	90	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1927 to 1931)[13]	Nov. 19	100	98½	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1931 to 1935)[13]	Nov. 19	100	97	98½	
Marblehead Lime Co. (1st Mort. 7's)[14]	Nov. 19	100	104	106	
Marblehead Lime Co. (5½% notes)[14]	Nov. 19	100	98	100	
Michigan Limestone and Chemical Co. (common)[6]	Nov. 20	....	26	....	
Michigan Limestone and Chemical Co. (preferred)[6]	Nov. 20	....	24	26	1¾% quar. July 15
Missouri Portland Cement Co.	Nov. 22	25	55¾	56¼	50c Dec. 15
Monolith Portland Cement Co. (common)[9]	Nov. 19	....	11½	12	
Monolith Portland Cement Co. (units)[9]	Nov. 19	....	28½	30	
Monolith Portland Cement Co. (preferred)[9]	Nov. 19	....	8½	9	
Nazareth Cement Co.[20]	Nov. 20	No par	39	41	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	Nov. 19	....	120	....	
New England Lime Co. (Series A, preferred)[14]	Nov. 19	100	....	95	
New England Lime Co. (Series B, preferred)[22]	Nov. 8	100	92	97	
New England Lime Co. (V.T.C.)[22]	Nov. 8	....	35	38	
New England Lime Co. (6s, 1935)[14]	Nov. 19	100	99	101	
North American Cement Corp. 6½s 1940 (with warrants)	Nov. 22	100	96	96¼	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[19]	Aug. 14	....	94	99	2 mo. period at rate of 7%
North American Cement Corp. (common)[19]	Nov. 8	....	20	22	
North American Cement Corp. (preferred)	Dec. 31	....	....	....	1.75 quar. Nov. 1
North Shore Material Co. (1st Mort. 6's)[15]	Nov. 23	100	98½	100	
Pacific Portland Cement Co., Consolidated[5]	Nov. 18	100	60	60½	½% mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	Nov. 18	100	96	97	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	Nov. 19	10	5½	6½	
Pennsylvania-Dixie Cement Corp. (1st Mort. 6's)[29]	Nov. 23	100	99	99½	
Pennsylvania-Dixie Cement Corp. (preferred)[28]	Nov. 23	100	....	99½	1¾% Dec. 15
Pennsylvania-Dixie Cement Corp. (common)[28]	Nov. 23	....	....	39⅝	80c Jan. 1
Petoskey Portland Cement Co.[1]	Nov. 22	10	9¼	9¾	1½% quar.
Pittsfield Lime and Stone Co. (2 sh. pfd. and 1 com.)[10]	Oct. 23	....	....	220	
Rockland and Rockport Lime Corp. (1st preferred)[10]	Nov. 20	100	105	....	3½% semi-annual Aug. 2
Rockland and Rockport Lime Corp. (2nd preferred)[10]	Nov. 20	100	60	....	3% semi-annual Aug. 2
Rockland and Rockport Lime Corp. (common)[10]	Nov. 20	No par	50	55	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	Nov. 22	100	115	125	$2 quar. Oct. 1
Santa Cruz Portland Cement Co. (bonds)[5]	Nov. 18	....	105¾	....	6% annual
Santa Cruz Portland Cement Co. (common)[5]	Nov. 18	....	80	....	$1 quar. $1 ex. Dec. 24
Superior Portland Cement, Inc. (Class A)[20]	Nov. 18	....	43	43¼	
Superior Portland Cement, Inc. (Class B)[20]	Nov. 18	....	21	22½	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	Nov. 23	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	Nov. 23	100	99	101	
United States Gypsum Co. (common)	Nov. 22	20	149	150	2% quar., $1.40 and 35% stk. ex. Dec. 31
United States Gypsum Co. (preferred)	Nov. 22	100	116½	119	1¾% quar. Dec. 31
Universal Gypsum Co. (common)[3]	Nov. 23	No par	10¼	10¾	
Universal Gypsum V.T.C.[3]	Nov. 23	No par	10	10½	
Universal Gypsum Co. (preferred)[3]	Nov. 23	....	73	77	1¾% quar. Sept 15
Universal Gypsum and Lime Co. (1st 6's, 1946)[3]	Nov. 23	100	96	....	
Union Rock Co. (7% serial gold bonds)[18]	Nov. 19	100	99	101	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15]	Nov. 23	100	98	100	
Wolverine Portland Cement Co.	Nov. 22	10	5¾	5¾	3% Nov. 15

[1]Quotations by Watling, Lerchen & Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee. Higginson & Co., Boston and Chicago. [11]Nesbitt, Thomson & Co., Montreal. Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson Jr. Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25]A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago.

QUOTATIONS ON INACTIVE ROCK PRODUCTS CORPORATION SECURITIES ON PAGE 76

Editorial Comment

Foreign Cement

The statement of H. Struckmann, head of the International Cement Corp., made to President Coolidge on the effect of foreign cement importation, is published elsewhere in this issue. It shows that there has already been a loss of $29,000,000 to the American people from the importation of cement. Of this, $16,000,000 only has been lost to the cement industry, the remaining loss having been shared by the railroads, the coal mines, the gypsum industry, the manufacturers of sacks and the makers of cement mill machinery and other essentials to the business. And this loss is being rapidly increased, as cement importation is increasing something like 100% a year.

Mr. Struckmann's figures are not to be received as those of a propagandist or a "case lawyer" would be. As the head of a corporation with cement mills in several countries as well as in various parts of the United States, no one can be more fully informed than he is on foreign cement and its effect on the American market. Furthermore, he has some of the most completely organized statistical bureaus at his command. And the cement business, as with all other basic American industries, is so thoroughly studied and analyzed that an error could hardly creep into such a statement. The figures must be accepted whether the interpretation is accepted or not.

The only other interpretation possible is that the loss to industry is balanced by the cheapening of construction. A moment's reflection will show that this cannot be true. By far the greater part of the money spent on construction is paid for labor and other materials than cement. Take one of the simplest of concrete constructions, a highway, for example. If foreign cement were to be used in one of those localities where it is most available it can be shown that the decreased cost would be around 2c per square yard. Does anyone suppose that more roads would be laid because the cost was $3.48 instead of $3.50 per square yard for the road in place with the subgrade? The saving of a cent or two a yard on its highways is as nothing to a community compared with what would be lost by the closing down of a plant so that a lot of men would be thrown out of work on account of foreign cement competition. And this has already happened in at least one instance.

American prosperity, according to every authority on the subject from Secretary Hoover down, is based on the continued employment of labor at high wages which are spent so that the money is turned into *productive* channels. The European idea of prosperity seems to be a return to the conditions of the 80's and 90's—ill-paid labor, with constantly decreasing wages, producing a flood of manufactured articles to be exchanged in foreign countries for cheap food and raw materials, and a piling up of profits to be spent in London, Paris and Deauville through *nonproductive* channels. The only reason why foreign cement comes to this country at all is to be found in the facts that foreign cement plant labor is paid from 60c to 90c a day; that a cement chemist gets little more, and that a cement mill manager thinks himself lucky to draw $150 a month as his salary.

To be sure, there is the matter of the payment of the foreign debts, owed to this country, by exports. But since, as has been shown by Mr. Struckmann, the imports of foreign cement have already caused us to lose $29,000,000, who is paying the foreign debts, the countries that owe them or the American people?

Other Products Threatened

Not only portland cement but other rock products are threatened by cheap-labor foreign competition. A large shipment of gypsum plaster from Germany is reported and German sand-lime brick is coming in ever-increasing amounts. Lime importations may be expected to increase. The combination of raw materials, everywhere abundant, with cheap labor and cheap ocean freights makes European manufacturers able to compete in these heavy products in spite of the better organization and knowledge of large scale production that Americans possess. Even Russia is getting into the game and in Russia, if all reports are true, technical skill and the knowledge of productive methods are at their lowest, but labor is cheap because it may be driven to work at the point of a rifle.

Neither those who have their money invested in the rock products industries nor the men who work in the plants should be asked to meet such competition. Nor should any consideration of international finance and the payment of war debts be allowed to affect us to such an extent that mills and factories in the United States will be closed down and men thrown out of work.

It seems time to return to the political and economic practices by which the industries of this country were established and built up. They have been objected to by writers on international policy and economics as unsound in theory, but the sufficient answer to every theoretical objection is that they *worked*. In the last analysis, neither the war nor any especial racial traits of the American people are responsible for our present prosperity. The real cause is the far-seeing policy that barred American industry from the competition of cheap labor.

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend rate
Benedict Stone Corp. (cast-stone) (100 sh. pfd. and 780 sh. com.)[1]	Nov. 10	....	$4700 for the lot	....	
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	....	12½	....	
Coplay Cement Mfg. Co. (preferred) (1)	Dec. 30	....	70	....	
Eastern Brick Corp. 7% cu. pfd.) (1)	Dec. 9	10	40c	....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	....	
Edison Portland Cement Co. (common)[4]	Sept. 11	50	20c	....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	....	
International Portland Cement Co., Ltd. (preferred)	Mar. 1	....	30	45	
Iroquois Sand & Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17	....	$12 for the lot	....	
Lime and Stone Products Co. (1100 sh. pfd., $10 par and 700 sh. com., $10 par)	Feb. 10	....	$66 for the lot	....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	....	104¾	104¾	3¼% semi-annual
Olympic Portland Cement Co. (g)	Oct. 13	....	....	£1⅝	
Phosphate Mining Co. (1)	Nov. 25	....	1@5	....	
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1)	June 23	....	$200 for the lot		
Rockport Granite Co. (1st 6's, 1934)[2]	Aug. 31	....	90	....	
Simbroco Stone Co. (pfd.)	Dec. 12	....	....	....	$2 Jan. 1
Southern Phosphate Corp.[6]	Sept. 15	....	1¼	....	
Vermont Milling Products Co. (slate granules) 22 sh. com. and 12 sh. pfd. (6)	Nov. 3	....	$1 for the lot	....	
Wabash Portland Cement Co.[1]	Aug. 3	50	60	100	
Winchester Brick Co. (preferred) (sand lime brick) (6)	Dec. 16	....	10c	....	

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925. (6) Price obtained at auction by Wise, Hobbs and Arnold, Boston, Mass.

Evansville Sand and Gravel Company in Receivership

A SCHEDULE in bankruptcy was filed on Friday, November 19, by the Evansville Sand and Gravel Co., Evansville, Ind., with Charles E. Harmon, United States commissioner at Evansville, Ind. The assets of the company are listed at $161,214.34 and the liabilities at $123,284.34. Adolph Decker has been appointed receiver for the company by the courts of Indiana, Kentucky and Illinois, the company having operated in these three states during the past several years. Three river boats are listed in the assets, the largest one of the boats being the *William Eichel,* valued at $45,000. There also are five barges and a sand and gravel quarry at Golconda, Ill. Some of the property of the company is located in Evansville and several of the boats and barges are at Paducah, Ky. A trustee for the company will be named for the company on December 1, it has been announced. The Evansville Sand and Gravel Co. is one of the oldest concerns of its kind along the lower Ohio river and has been doing business for a number of years.

Pennsylvania-Dixie Cement Stock Listed

THE New York Stock Exchange has authorized the listing of (a) $13,000,000 series A convertible 7% cumulative preferred stock (par $100) and (b) 400,000 shares of common stock (no par value), with authority to add 195,000 shares of common stock which is reserved by the corporation for the conversion of the series A preferred stock.

Sales.—The net sales of the predecessor companies for the three years and seven months ended July 31, 1926, are shown below.

Dividends.—The directors have declared an initial quarterly dividend of 1¾% on the outstanding convertible 7% cumulative preferred stock payable December 15, and an initial dividend of 80 cents a share on the outstanding 400,000 shares of common stock (no par value) payable January 1, 1927.

For further details regarding the company see ROCK PRODUCTS, October 2 issue.

NET SALES OF PENNSYLVANIA-DIXIE CEMENT CORP. (1923-26)

	Calendar Years 1923	1924	1925	7 Mos. ended July 31, '26
Dexter Portland Cement Co.	$ 1,663,113	$ 2,140,618	$ 2,186,251	$2,230,222
Penn-Allen Cement Co.	1,536,548	1,688,032	1,868,610	
Clinchfield Portland Cement Corp.	2,311,313	2,348,158	2,603,327	2,070,263
Dixie Portland Cement Co.	2,491,860	2,466,367	2,547,301	1,523,739
Pennsylvania Cement Co.	3,809,601	4,160,830	4,694,534	2,516,484
Total	$11,812,435	$12,804,004	$13,900,023	$8,340,708

North American Cement Third Quarter Earnings

NORTH AMERICAN CEMENT CORP. of Albany, N. Y., reports for quarter ended September 30, 1926, net earnings of $416,947 after depreciation and depletion, but before interest, amortization and federal taxes, compared with $431,063 in the preceding quarter and $105,478 in March quarter this year. Net earnings for first nine months of 1926 totaled $953,488 on above basis.

The net income of $416,947 for the third quarter was equal to 3.30 times bond interest requirements. After fixed charges, amortization and federal taxes, net income was equal to $4.62 a share earned on the outstanding preferred stock, and after preferred dividends a balance equal to $1.11 a share was reported earned on the outstanding common stock.

For September alone the company reports bond interest earned 3.56 times, while $1.74 a share was earned on the preferred stock and 44 cents a share on the common stock.

Extensive improvements involving the expenditure of $4,000,000, increasing plant capacity of North American Cement Co. from 2,700,000 to 4,700,000 bbl., have been completed. The various plants are operating at capacity and September shipments established a monthly record for this year. Shipments of cement for nine months ended September 30, 1926, exceeded production, necessitating withdrawals from stocks on hand.

Indiana Limestone Quarterly Report

INDIANA LIMESTONE CO., Bloomington, Ind., has just made public its first report since organization, showing the results for the first complete quarter operations. The income account reports sales for the period of $3,715,992, and net income after depreciation and depletion, available for interest of $888,665, which shows total interest requirements covered 2.84 times. Net available for common stock dividends after payment of preferred dividends and reserve for taxes was $403,165, or 27 cents a share on 1,500,000 shares of no par value.

Cement Securities as an Investment

A NEW YORK brokerage concern with branches in many parts of the world has issued an interesting pamphlet called simply, "Cement," giving the advantages of cement manufacturing from the investor's point of view. It is a well written paper and the argument is backed up by sufficient statistics to show the position of cement as a great basic industry.

Perhaps the most interesting part is an analysis of what would happen if the building industry should slacken. It is shown that if building were to fall off even as much as 25%, which is as much as the gloomiest prophet would predict, cement would not be seriously affected as it is used in many other places.

It is pointed out that cement mills are now operating on 85% capacity and that if the construction of public and commercial buildings and houses were to decline one-half it would decrease the operating capacity only to 70%. In 1918 it is stated that cement plants operated at 51.6% of capacity and still some made money.

It is an error, however, to state, as this pamphlet does, that "no one thinks of natural cement any more." Natural cement making is still a living and growing industry with a market all its own, although of course its output is only a small fraction of that of the portland cement industry.

Lime Treatment of Earth Roads*

By H. W. Wood, Jr.
Highway Department, National Lime Association

THE investigation of the action of lime on road soils was started about two and one-half years ago by the National Lime Association cooperating with the University of Missouri, and by the United States Bureau of Public Roads cooperating with several state highway departments. This investigation has consisted of laboratory work, together with field tests, and several things have been discovered which might be of interest here.

In making the lime treatment, hydrated lime is thoroughly mixed into the road soil to a depth of 6 in. by plowing and disking. The road should be quite dry when the treatment is made, in order to get an intimate mixture. The road is then dragged to the proper cross section and opened to traffic, which quickly packs it.

Lime treatment greatly stabilizes heavy clay and silt soils. These soils immediately lose their stickiness and extreme plasticity, becoming granular in structure, which renders them capable of sustaining normal traffic loads without failure when wet.

Up to this point we have been well satisfied with the success of the lime treatments, but lacked a practical test to guide us in making recommendations.

In order to determine this stabilizing effect accurately, a series of investigations was conducted at Ohio State University under the supervision of Professor Eno to devise a test for measuring the stability of soils in the laboratory. The soil to be tested is placed in a steel cylinder 3 in. in diameter and is forced through a 1½-in. hole in the bottom by means of a plunger, the load being applied in a universal testing machine.

When the soil holds a definite percentage of water, the load required to force the soil through the hole is a measure of its stability, or its resistance to deformation under load.

On several clay soils tested by this method a lime treated soil holding 30% of water showed twice the stability of the untreated soil holding only 25% of water. In view of the fact that most clay soils fail under traffic when holding about 25% of water, an increase in their stability in this range of wetness may often prevent a failure of the road. It will be seen that there the untreated soil with 25% of water would fail under traffic, while the lime treated soil containing 5% more water would remain smooth and unrutted. That is exactly what we found in the actual field tests.

There are several practical uses for lime treatment of soils. On a back road in the country, where the traffic is not heavy and where a hard surface road would be too expensive, it seems advisable to treat the troublesome clay sections with lime. By thus keeping these sections hard and firm at all times, many miles of road will be kept open to traffic in rainy weather and after the spring break-up.

Where traffic is heavy enough to warrant a better road, the subgrade may be treated with lime and the surface covered with a thin layer of crushed stone or gravel. Without the lime this thin layer of surfacing material would soon sink into the clay and disappear; but with the increase in stability and loss of plasticity due to the effect of the lime, the thin layer of gravel or crushed stone will remain on top. This will result in a saving of five or six inches of gravel or stone.

Maintenance on a lime treated road is simplified in several ways. (1) The soil loses its stickiness and is not picked up by the wheels of vehicles, to fall on the road and form clods. This keeps the road from becoming rough. (2) The increased stability of the soil prevents the wheels of vehicles from cutting ruts after the surface begins to dry. (3) The lime treated road dries out faster and can be dragged many hours sooner than the road without lime. (4) The treated soil mulches more easily under the drag, making it easier to obtain a smooth riding surface.

Another possible use of the lime treatment is in connection with aviation landing fields. We are contemplating such a test on the air port in Cleveland, Ohio.

Test roads are being built in Wisconsin using a thin gravel surface over the lime treated subgrade. This work will be done by the Maintenance Section of the Wisconsin State Highway Department.

The University of Illinois is building several test sections near Champaign to determine the value of lime treatment preparatory to oiling earth roads. It is expected that the lime will stabilize the soil and at the same time prevent the emulsifying of the oil by the clay. Both of these should lengthen the life of the oiled surface.

In Missouri and Virginia, sections are being treated with lime to obtain further information concerning its use on earth roads without the addition of any surfacing material. In Ohio, another short section of subgrade for concrete pavement has just been completed, and the tests in the laboratories at Ohio State University are progressing. With the results of all these tests compiled, together with the results already obtained in previous tests, definite recommendations for lime treatment of earth roads, subgrades and aviation landing fields can be made.

This project has now been brought out of the experimental stage, for the new test will enable us to recommend the amount of lime required on any soil. With some knowledge of local conditions as to grade, location and drainage, we can tell how deep the treatment should be.

*Paper presented before the Eight Annual Convention, National Lime Association, June, 1926.

Water-Ratio Concrete Theory Best Applied to Uniform Aggregates

A. P. GOLDBECK, chief of the engineering bureau of the National Crushed Stone Association, has published an interesting article on the "Water Ratio Method for Proportioning Concrete Mixtures." In closing he makes the following interesting comments:

"It is sometimes stated that the water-ratio theory of proportioning concrete makes it possible to use any aggregate no matter how graded just so long as it is clean and structurally sound. Such a statement, however, is erroneous for it is entirely impracticable to continuously change the concrete proportions during the progress of the work just to suit the changes in grading of the aggregates. Yet this would have to be done to insure concrete of a uniform quality and strength when such variable material for instance, as pit-run gravel, is used. This method of proportioning concrete will always be most successful when commercially prepared uniform aggregates are employed, for then the proportions once having been determined may be used continuously.

"The water-raito method of proportioning is merely a general law from which there doubtless are individual variations. When greater accuracy is required, such as in determining the relative economy of available aggregates, strength tests should be made on concrete containing these aggregates in varying proportions."

Recommends Missouri Farmers to Use Limestone for Soil

MANY Missouri farms can be changed from a liability to an asset by the use of limestone to sweeten the soil and the growing of leguminous crops as feed for live stock and soil improvement, says, R. J. Silkett of the Missouri College of Agriculture, according to the Milan (Mo.) *Republican*. This is being done on a large scale in southwest Missouri, where profitable crops of clover and alfalfa are being grown.

"Experiments conducted for 16 years by the Missouri College of Agriculture on 11 different types of soil disclose the fact that for every dollar spent for lime a return of $1.73 has been secured. Some farmers have adopted the practice of using a car or two of limestone each year. In this way 20 to 40 acres can be limed each year at a rate of two tons per acre. This means that a farm with 80 tillable acres can be completely limed in two to four years.

The demand for agricultural limestone is increasing every year. Missouri used 102,000 tons last year, and Illinois, 800,000.

J. King McLanahan

J. KING McLANAHAN, president of the New England Lime Co. of Pittsfield, Mass., vice-president of the Marblehead Lime Co. of Chicago and interested in many other financial and rock products enterprises,

J. King McLanahan

died suddenly at his home in Pittsfield, Sunday, November 14. He was only 54 years of age and almost to the hour of his death he seemed to be in good health. His death was due to heart failure and, while it was known that his heart was affected, his condition had not been considered serious, so the news of his demise came as a shock even to his family and intimate friends.

Mr. McLanahan was born in Hollidaysburg, Penn., where he was buried on November 16. He was the owner of a girls' school in Hollidaysburg which his father owned before him and he was also connected with a bank and other institutions in his native city. The latter part of his life was spent in Pittsfield, which was the headquarters of the New England Lime Co., and he moved there from Danbury, Conn., when the offices of the company were moved.

His wife, two daughters and a brother survive him.

Mr. McLanahan was one of the finest of the type of business man that America best produces, alert, active, vigorous, undertaking many things and carrying them through to success and at the same time finding opportunities for making enduring friendships and for attending to those public duties which every prominent man finds thrust upon him. His work in connection with two of the more important lime companies was enough to take up an ordinary man's time, but in addition to this he looked after his interests in financial and other institutions, took a deep interest in education, with which he was so closely connected, and belonged to many clubs in widely scattered cities in the eastern states. As for his genius for making and keeping friends, this cannot be better shown than by mentioning that a number of people have either written or called up Rock Products since his death to speak of him and to express the sense of personal loss they felt in his passing. The loss to the rock products industries by his death is a real loss, but there is satisfaction in the thought that the inspiration of his life and helpful and constructive work he did in these industries still remains.

Rebuilt Birmingham Plant of Woodstock Slag in Operation

THE new crushing plant of the Woodstock Slag Corp. of Birmingham, Ala., which replaces the one totally destroyed by fire in July, is reported in full operation. This plant is located at Woodward, Ala., using the slag of the Woodward Iron Co.

The latest types of crushing and screening equipment are said to have been installed in the new plant.

G. A. Mattison is president of the Woodstock company and George A. Mattison, Jr., vice president, general manager and treasurer. E. L. Goolsby is secretary. Offices are at 808 Southern Railway Building, Birmingham.

Canada Shipments of Mica Lower in 1925

SHIPMENTS of Canadian mica during 1925 amounted to 4020 tons, valued at $261,463, according to finally revised statistics of the bureau of statistics. In 1924 the total production was 4091 tons with a value of $357,272.

The quantity of scrap mica marketed showed a considerable increase to a total of 3540 tons, or 130 tons in excess of the sales of 1924.

Exports of rough-cobbed, thumbed, trimmed and splittings decreased materially, while scrap mica exported increased 472 tons to 4991 tons.

Growing Importance of Highway Maintenance

WRITING to the *Constructor,* G. F. Schlesinger, director of highways and public works in Ohio, calls attention to the increasing importance of highway maintenance. He estimates that $2,700,000,000 will be spent on new highways in the United States in the next five years and that $782,000,000 will be spent in the same period for maintenance. If resurfacing is included with maintenance, the amount is raised to $1,600,000,000.

Charts show that the probable population of the United States in 1930 is 119,000,000 inhabitants. The expected motor vehicle density at that time is one motor vehicle to five persons or about 24,000,000 vehicles. The annual cost of maintaining highways has been shown to be about $7000 per 1000 vehicles. The trend for the present may be upward but as better design and a better understanding of traffic needs develops less maintenance will be required. Widening and resurfacing of roads will also call for large expenditures.

Rule Against Marking of Imported Slate

IMPORTED roofing slates, along with roofing tiles, wall tiles and the like, should be regarded as building material and therefore should be admitted through the customs without any individual markings other than on the packages, L. C. Andrews, assistant secretary in charge of customs, has informed collectors of customs in a letter circularized throughout the service.

The question arose through a request from the Customs Information Exchange for a ruling on the marking of imported roofing slates, and also a question put by the Collector of Customs at New Orleans affecting a consignment of the same commodity.

The tariff ruling, the letter says, is not intended to apply to articles other than common building brick, standard American size.

Phosphate From Makatea Island

IN 1925 Makatea, an island of the French Polynesian group in the Pacific, exported 81,061 metric tons of phosphate, of which approximately 45,000 tons went to Sweden, 35,000 to Japan, and 5,000 to Hawaii. The deposits are exploited by the Compagnie Francaise des Phosphate de l'Oceanie, a French corporation, with its head office in Paris. It is affiliated with the Anglo-French Phosphate Co., London. The manager of the concern believes that the 1926 exportation will reach about 125,000 metric tons with shipments of perhaps 50,000 tons to Japan, 45,000 to Sweden, 20,000 to Australia and 10,000 to Hawaii.

The island, about five miles long and four miles wide, was probably a coral atoll, and in places has an altitude of more than 100 ft. The French company does not own the land, but has the exclusive right of exploitation. The amount of phosphate on the island is estimated at approximately 10,000,000 tons. It is found everywhere and is produced without great technical difficulties. —Consul Lewis V. Boyle, Tahiti, in *U. S. Commerce Reports.*

Florida Phosphate Shipments

DURING the first 10 months of this year 1,076,122 tons of phosphate were shipped by water from the elevators of the Atlantic Coast Line and the Seaboard Air Line near Tampa. Phosphate shipments of the two railroads for October totaled 84,881 tons, which was 17% less than the amount shipped in October, 1925.

How Importing Cement Has Cost Us $29,000,000

Statement Made by H. Struckmann of International Cement Corp. to President Coolidge

IN a statement forwarded to President Coolidge Saturday, November 13, H. Struckmann, president of the International Cement Corporation, which is now one of the world's largest cement producers, with 11 mills in North and South America, asserts that the consumption of 10,000,000 bbl. of foreign-made cement in this country since 1920 has resulted in a loss of $29,000,000 to American industry and says that the growing use of foreign-made cement and other bulk commodities, produced abroad by low-priced labor, threatens to become a brake on American prosperity.

It is stated that the cement industry has lost $16,000,000, the largest single item of which is wages and salaries, the coal industry $1,462,500, power companies $1,700,000 and the railroads $7,182,400, and that the entire range of American industry is affected by the losses incurred through the use of the foreign-made product. The statement, which is being circulated among cement consumers, engineers, architects and public officials under the title "Importing Foreign Cement and Exporting American Prosperity," reads in part as follows:

"Since 1920, users of cement in the United States have purchased approximately 10,000,000 bbl. of foreign-made cement. This represents a loss to American business amounting to $29,000,000, including a net loss of $16,315,000 to the cement industry, the largest single item of which is wages and salaries; a loss of $7,182,400 to American railroads; $1,462,500 loss to coal and oil companies, $1,700,000 loss to power companies and correspondingly important losses to sack manufacturers, cotton growers, explosive manufacturers, manufacturers of miscellaneous supplies and repair parts and to the American gypsum industry.

"Approximately 50% of the total quantity of imported cement comes from Belgium. Cement mill labor in Belgium gets the equivalent of 90 cents gold a day. American cement is made by men receiving five times as much; that is, $4.50 a day. Cheap labor, together with low cost fuel, the principal items in the cost of cement manufacture, have resulted in the production of large quantities of foreign-made cement for export. A great deal more cement is produced in Europe than is required for local consumption, and low canal tolls from inland points in Belgium, France and Germany, together with cheap ocean freights to this country, enable the foreign manufacturer to undersell the American producer.

"The statement is sometimes made that by purchasing the foreign-made product we are indirectly helping Europe to get back on her feet. It is important for Americans to understand, however, that we cannot help Europe by hurting American business. The net result of that attitude would ultimately mean just one thing, reducing our living standards to a level with theirs. That in effect is what is being done when we send $29,000,000 worth of American prosperity abroad in exchange for 10,000,000 bbl. of foreign cement. That amount of money or its equivalent has gone out of the country and practically every industry in this country has been directly or indirectly affected as a result.

"First there was the loss to the cement industry of approximately $16,000,000, the largest single item of which is wages and salaries. That is a sizable item and it means lessened purchasing power of American workers who would have earned this money. That in turn means reduced business all along the line.

"But that is only a small part of the loss to this country. American coal and oil companies lost the sale of 650,000 tons of coal or its fuel-oil equivalent. That is about $1,462,500 more out of the American pocket.

"Then there is the loss of $1,700,000 which would have been spent for power in producing this cement. Gypsum mines lost $199,500 worth of business; manufacturers who furnish parts and sundry supplies to cement mills lost sales amounting to $1,000,000.

"But that isn't all. There is also the loss of approximately $7,182,400 to American railroads—$6,350,000 on the transportation of cement, $650,000 on coal, $182,400 on gypsum and a substantial sum on sacks, parts and other material, as well as a loss to sack manufacturers of $960,000, while the makers of explosives lost $130,000.

"The greater part of these sums would have gone into wages and thence have been converted into business for those who make and sell the necessities and comforts of life, so it is obvious that practically the entire range of American industry is adversely affected. Then the governments, both national and state, lose revenue because of the reduced taxable income, and that loss results indirectly in higher taxes on a smaller volume.

"All this definitely affects prosperity. It may not have been noticed while things were zooming along at record-breaking levels, particularly in the construction industries. But it will mean better business for American industry as a whole if the cement-consuming industries remember that in reality it is their own customers who are hit every time they buy foreign-made cement.

"Since 1920 those who have purchased foreign cement made a 'saving' of from 15 to 30 cents a barrel. But that saving actually cost America $29,000,000 worth of prosperity. 'Savings' such as that are pretty expensive. The same conditions apply to other heavy commodities, such as pig iron, iron and steel products, brick, glass and the like, which are being imported in large quantities. If the present trend continues it will mean a veritable flood of these heavier products and a real menace to American prosperity. We Americans must realize in time the paramount importance of keeping our money working at home.

"Europe is producing more cement and other heavy commodities than she did before the war. But her ability to buy them herself is considerably diminished. As long as that condition continues, this menace to American business will remain with us. America must wake up, or find her own prosperity seriously impaired.

"Money raised through taxation is being spent by city and state governments for foreign-made cement and other products, with resulting losses to the very people who pay these taxes. These governments are penalizing their own citizens, who depend upon American industries for their livelihood, just as they are handicapping industries whose capital has been encouraged to invest in their midst.

"A change in viewpoint seems slowly to be coming about. The governor of one state recently instructed his department heads to specify only American-made cement, because he saw the eminent fairness of that course both to the people of his state and to the capital which helps to provide them with employment."

The following table showing imports of cement in detail is from the pamphlet, "Importing Foreign Cement and Exporting American Prosperity," referred to above:

WHERE THE IMPORTED CEMENT CAME FROM—LISTED IN BARRELS BY COUNTRIES

Imported from	1922	1923	1924	1925	1926 (to Aug. 1)	Total
Belgium	10,682	200,718	1,021,213	1,919,239	1,567,250	4,719,102
Canada	127,216	228,594	42,953	711,053	62,357	1,172,173
Norway	125	420,233	532,089	593,621	47,375	1,593,443
Denmark	118,499	370,410	346,354	351,484	347,450	1,534,197
Sweden	60,492	211,555	15,466	....	....	287,513
England	12	186,152	28,852	6,160	62,027	283,203
France	1,668	1,703	5,451	12,450	48,094	69,366
Germany	....	47,344	11,957	16,961	5,284	81,546
All others	5,129	11,927	6,601	44,349	94,966	162,972
Total	323,823	1,678,636	2,010,936	3,655,317	2,234,803	9,903,515

Foreign Abstracts and Patent Review

Improving Quality of Aluminous Ciment Fondu. Other siliceous materials containing alumina and in the nature of aluminus silicates are substituted for alumina. Clay marl, kaolin, slag, coal ash, etc., are used in the manufacture of a fused cement, and various substances, such as fluorspar and alumina are also added to dissolve and bind the silicic acid ingredients.

Another claim in the patent applications describes the addition of the requisite lime in this cement in the form of quicklime, limestone, lime marl, fluorspar and the like. The solution and the binding of the silicic acid as well as the melting of the entire mass can be accomplished in a single operation.

In case fluorspar is added to this cement, then the fluorine which is driven out of the fluorspar or the hydrofluoric acid which is formed combines with a portion of the silicic acid present in the cement mass to form silicon fluoride compounds. *German Patent Application No.* 95,773.

Cement and Phosphorus from Phosphate Rock. The I. G. Farbenindustrie A. G. has patented a process for the production of cements and phosphorus by the reduction of crude phosphates with carbon and silica at high temperatures. Such ingredients as clay or alumina are added. In a particular case bauxite is added to the residue obtained on fusing a mixture of crude phosphates, sand and coke in an electric furnace. Bauxite may also be used in the original mix in the place of sand. *British Patent No.* 252,367.

Determination of Amount of Cement in Mortars and Concrete by the Silicic Acid Method. A 1-gm. sample of cement or a 4-gm. sample of mortar is digested with 50 to 60 c.c. of boiling hot hydrochloric acid of 1.12 sp. gr. The solution is then filtered and the silicic acid is determined in the filtrate. In this method the silicic acid of the clay and the sand remains unchanged, so that the proportion of silicic acid determined forms a measure for the amount of cement that is contained in the concrete or like mixtures. Thus it is found that portland cement contains from 20.7 to 21.2% of soluble silicic acid, ciment fondu 8.65% of soluble silicic acid and slag cement from 23.8 to 24.4%.

In mixtures of one part of cement to three parts of lime and sand or silica sand, by this method the cement contents are found to be from 23 to 26.5%; or in close agreement with the amount of cement actually used. *Comptes rendues,* **183,** 53-55.

Cause of Setting Trouble in Aluminous Cement. A layer of material, which can easily be removed with the finger, often forms on the surface of blocks of aluminous cement, while the remainder of the block may be entirely free from fissures. This "sanding" of cement samples prepared for testing has been held to be due to the action of the atmosphere, particularly the carbon dioxide in air. Lime-poor portland cements have also shown this condition and while investigation has shown that this effect takes place in the presence of air, nevertheless it has also been found that it will ensue in the absence of carbon dioxide. Thus it is assumed that the "sanding" is due not to the action of carbon dioxide but to the evaporation of water from the surface of the cement block.

This uncertainty led to tests being made with a number of blocks of aluminous cement. The blocks were made from cement with the addition of 25% of water. The samples were made on glass plates and directly after they had been formed, they were placed in atmospheres of known composition.

Tests were first made in moist air. The sandy layer was about 1 mm. thick composed of a ½ mm. upper layer of small flakes and an under-layer of the same thickness which can be removed with the finger. Both layers are light brown in color, while the rest of the block was a brownish gray. The under side of the block was hard and highly lustrous.

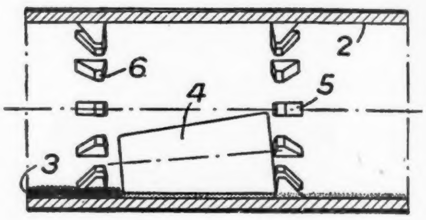
The samples were also tested under a glass bell-jar through which moist carbon dioxide was passed. The "sanding" of the cement was more noticeable than in the first case. The upper layer of fine flakes was about 0.8 mm. thick and the total thickness of the "sandy" film was from 1.5 to 2 mm. The color and the condition of the under side were the same as above.

The samples were then tested in a dessicator which contained potassium hydroxide, the atmosphere in the same being free from carbon dioxide. The samples were all colored a dark gray. The surface could be scratched with the finger nail. Tests made in an atmosphere of oxygen over potassium hydroxide showed perfect setting and a black coloration in the moist condition. In the absence of all air the tests showed the "sanding" action to take place only when there was contact between the atmosphere and the sample.

It was concluded from the tests that the presence of carbon dioxide is the defining factor in "sanding" action. It was also shown that the important consideration from a practical standpoint, when the cement was in contact with the atmosphere, was to avoid as far as possible evaporation of the water in the cement. Furthermore, it was found that "sanding" is not manifested at all or to a very slight degree only in the case of mortar.

The fundamental cause of the strong action of carbon dioxide is found in the sensitivity of the hydrated calcium aluminate to carbonic acid gas. This sensitivity is apparently particularly strong during the formation of hydrate in the setting process, for the completely set aluminous cement does not undergo any change when subjected to the action of dry carbon dioxide gas. The decomposition of calcium hydroaluminates by carbon dioxide has also been studied. Further tests have been instituted to determine whether or not water containing carbon dioxide has any effect on the hardening of aluminous cement. *Zement* (1926), **12,** 245; **15,** 714.

Nodule Grinder in Rotary Kiln. The process and apparatus are applicable to the burning of cement and slurry and pertain to the use of the rotary kiln. Thus in the rotary kiln in which the cement is burnt, the nodules formed by drying the slurry in the drying zone of the kiln are ground before they pass to the calcining zone. Nodules (3) at the end of the drying zone pass beneath a grinding member (4) rolling on the kiln lining (2), and held in place by two series of projections (5) and (6). In a modification, a number of grinding chambers are attached to the kiln, and communicate therewith through inlets for the nodules and outlets for the ground material. *British Patent No.* 255,569.



Nodule grinder in rotary kiln

Use of Gypsum in Removing Ammonia from Coal Gas. Ammonia concentrate (15%) is saturated with carbon dioxide gas obtained from flue gases in a packed tower. Gypsum is added to this solution in small quantities with constant stirring. The calcium carbonate is filtered off and the liquor passed through a still to remove the remaining ammonia. The liquor is then evaporated until ammonium sulphate crystallizes. Another method which is direct consists of washing the gas with a concentrated calcium sulphate solution in a packed tower. The calcium carbonate sludge is drawn off in continuous steps and the liquor evaporated to crystallization of the ammonium sulphate. Both methods have been worked out on a laboratory scale. The removal of ammonia it has been found is incomplete and depends chiefly on the temperature and volatile ammonia content of the scrubbing liquor.—*Gas Journal* (1926) **175,** 428.

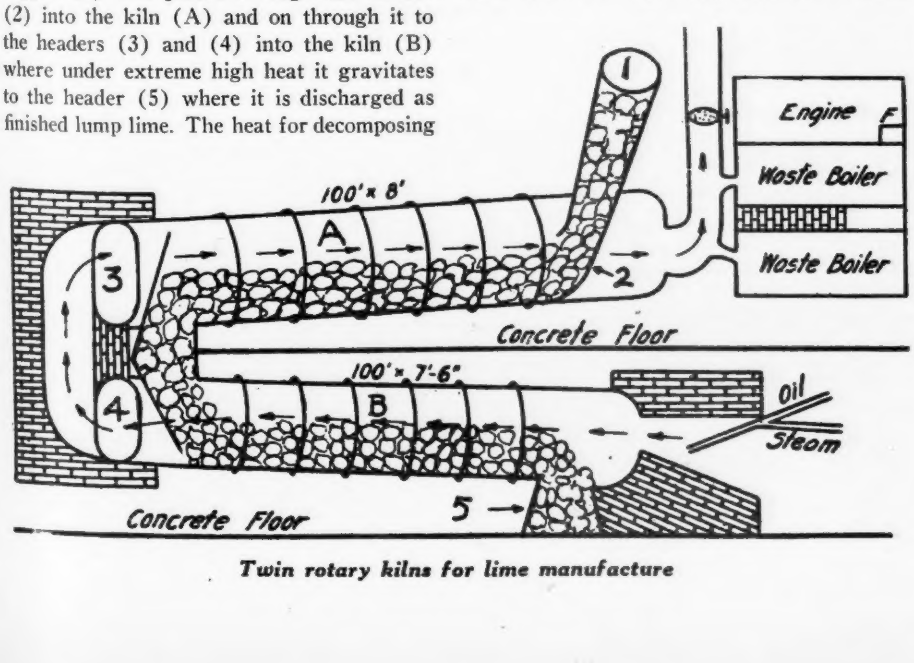
Phosphate Fertilizer. Process for the manufacture of phosphate fertilizer which comprises mixing ground phosphate rock with sulphuric acid and phosphoric acid in such concentration, quantities and relative proportions that a slurry which is sufficiently thin and mobile to be readily mixed is formed and which upon standing without artificial drying will form a mass which is easily disintegrated into a granular powder suitable for use in fertilizer distributing machinery.—*E. L. Larison, U. S. Patent No.* 1,604,359.

Artificial Stone. A dry mix of portland cement, flowers of sulphur and talc is prepared and to this is added sufficient of a wet mix to reduce the dry materials to a desired plasticity. The wet mix consists of iron oxide, calcium chloride and alum water in different proportions.—*H. W. Johnston and M. P. Miller, U. S. Patent No.* 1,604,169.

Colored Cement and Process for Its Manufacture. The coloring matter for the cement in the unground state is added to the cement clinker and both ground to the required fineness in the finish mill at the cement plant. A uniform mix of cement and color results and a savings in costs over the usual method of individual grinding of color and cement and the mixing to produce the colored product is claimed for this process.—*W. J. Reardon (Patent Applied For).*

Artificial Stone from Lime and Limestone. Fine ground limestone is mixed with lime and sufficient water to form a slurry and molded under pressure. The dried stone is then slightly moistened and placed in a suitable container and subjected to the action of carbonic acid gas under increasing pressure during the period of carbonation. *H. C. and H. H. Harrison, U. S. Patent No.* 1,599,413.

Twin Rotary Lime Kiln. Limestone broken to about 2x6x8-in. size is fed to the hopper (1) and passes through the header (2) into the kiln (A) and on through it to the headers (3) and (4) into the kiln (B) where under extreme high heat it gravitates to the header (5) where it is discharged as finished lump lime. The heat for decomposing the limestone is obtained from fuel oil and enters the lower kiln (B) moving in an opposite direction to the flow of material.—*Max Herman, U. S. Patent No.* 1,459,302.



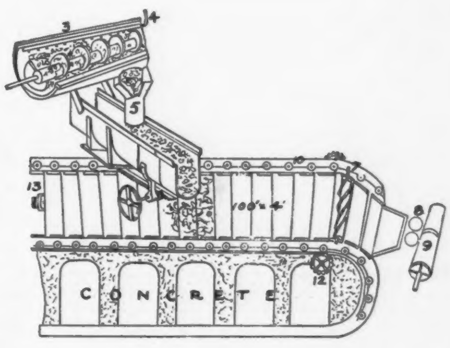
Twin rotary kilns for lime manufacture

Alumina, Alkali and Dicalcium Silicate from Siliceous Materials. Natural or artificial siliceous materials are fused or sintered in a rotary kiln. The materials are so chosen that the sintered residue will have the following approximate composition: $2CaO{\cdot}SiO_2{\cdot}Al_2O_3{\cdot}1.7(K_2O$ or $Na_2O)$. Iron oxide or titanic oxide if present as impurities do not interfere with the process and may be allowed for in proportioning the raw materials. The sintered mass is then leached and the dissolved liquor containing alkali aluminate treated to recover the alkali and alumina. The insoluble residue can be used for the manufacture of sand-lime brick or by the addition of lime made into a hydraulic cement. Natural materials such as leucite orthoclase, albite, or zeolites and artificial materials made of clay, limestone, sodium carbonate and silica or a mixture of calcium salts and clay and alkali metal carbonates are used in this process. *A. H. Cowles, U. S. Patent No.* 1,591,364.

Di-ammonium Phosphate from Rock Phosphate. Finely ground crude phosphate rock $Ca_3(PO_4)_2$ is mixed with an aqueous solution of ammonia, and the mixture is charged with sulphur dioxide, which produces calcium sulphite and di-ammonium phosphate in accordance with the following equation:
$Ca_3(PO_4)_2+4(NH_4)OH + 3SO_2 + 3H_2O = 3CaSO_3 + 2(NH_4)_2HPO_4 + 4H_2O$. —*Henry Blumenberg, U. S. Patent No.* 1,601,233.

Producing Glossy Surfaces on Cement Products. Composition containing aluminous or portland cement is cast in a mold having a smooth or polished surface and left until the initial set has taken place and then removed. *Speranza Seailles, U. S. Patent No.* 1,600,514.

Lime Hydrator. Lump lime is conveyed to a screw conveyor (3) provided with a ⅜-in. perforated pipe (4) to sprinkle the lump lime with water while the screw in the conveyor is turning the lumps over and over for a thorough wetting, care being taken not to soak the lumps to form a putty. A hopper (5) takes the sprinkled material to a distributor (14) which distributes the material on a slow moving endless apron conveyor. The lump lime is thus gradually hydrated and falls to a powder and is swept by a brush (7) to a storage bin. Any lumpy material is crushed by rollers (9) and screened. The entire apron conveyor is covered by a galvanized iron enclosure to keep dust and gases from escaping.—*Max Herman, U. S. Patent No.* 1,462,284.



Continuous lime hydrator

Dewatering Cement Slurry Before Calcining. Cement slurry is passed to a film drier consisting of co: tinually rotated drums internally heated by exhaust steam from a waste heat power plant and by this means loses some of its water by evaporation. The slurry thus treated may leave the driers either as dry as possible or to a lesser extent if desired and enter the cool end of the kiln as a dried powder. *Thomas Rigby, U. S. Patent No.* 1,600,846.

Waterproofing Concrete. Paraffin, emulsified with kerosene and soap water, is introduced into the mixing water used in making the concrete to prevent entrance of water or other liquids after the concrete has properly set and hardened. *Edwin C. E. Lord, U. S. Patent No.* 1,599,903.

Apparatus for Calcining and Clinkering With Recovery of Byproduct Heat and Byproducts. In combination with a calcining means, a separate clinkering means, means for conveying hot calcined material from the calcining means to the clinkering means, a flue leading from the clinkering means for conveying hot gases therefrom, a precipitator within the flue for treating the gases for the recovery therefrom of their alkali content, cooling means in said flue intermediate the precipitator and clinkering means, and means for supplying a deficiency of sulphur to said flue intermediate said clinkering means and said cooling means. *Robert D. Pike, San Mateo, Calif. U. S. Patent No. 1,596,509.*

Portland Cement Association Selects G. S. Brown as President

Dust Collection, Accident Records and Foreign Competition Discussed at Annual Meeting

G. S. BROWN, president of the Alpha Portland Cement Co. of Easton, Penn., was elected president of the Portland Cement Association at the annual meeting conducted at the Drake hotel, Chicago, November 15, 16 and 17. Mr. Brown succeeds Blaine S. Smith, vice-president and general sales manager of the Universal Portland Cement Co.

Col. E. M. Young, president of the Lehigh Portland Cement Co., Allentown, Penn., and Robert B. Henderson, president of the Pacific Portland Cement Co., San Francisco, were elected vice-presidents. John W. Boardman, vice-president of the Huron Portland Cement Co., Detroit, was re-elected treasurer.

New members of the board of directors are: L. R. Burch of New York City, vice-president of the Atlas Portland Cement Co.; Richard Hardy of Chattanooga, chairman of the board of directors of the Pennsylvania-Dixie Portland Cement Corporation; Blaine S. Smith of Chicago, vice-president of the Universal Portland Cement Co.; L. T. Sunderland of Kansas City, Mo., president of the Ash Grove Lime and Portland Cement Co., and C. E. Ulrickson of Dallas, vice-president of the Trinity Portland Cement Co.

Dust Prevention the Principal Topic

During the three days of the convention many problems were discussed in committee meetings and in general sessions. A "Symposium on Dust Collection" was presented Tuesday, November 16, by J. B. Taylor, who spoke on "Some Aspects of the Dust Problem"; J. H. Kempster, whose topic was "Dust Collection and Prevention in Packing and Grinding Departments"; Walter A. Schmidt, who talked on "Electrical Precipitation of Dust in Portland Cement Plants," and Frank Moyle, who spoke on "Cyclone Dust Collectors."

Progress in accident prevention work was reported by the accident prevention committee. During October, 73 of the 127 plants reporting came through without a single accident. Each year a substantial reduction in accidents has been secured over the previous year and mishaps have been reduced by one-half since the formation of the Accident Prevention Bureau of the association.

At the business session Mr. Smith, the retiring president, reviewed the portland cement industry for the past year and pointed out certain conditions which will influence the industry in the near future.

Reviewing the Cement Industry in 1926

Mr. Smith in part spoke as follows:

"Everything considered, it is not difficult to believe that unless something unforeseen occurs a large construction program can be expected next year, and consequently a good cement demand, although an increase over this year's consumption is not likely.

G. S. Brown, new president of the Portland Cement Association

"A year ago, if we could have been assured that shipments in 1926 would exceed those of the year before, most of us would have felt relieved. At that time prospects of such a showing were not promising, yet government figures for ten months indicate total shipments for the year of 162,000,000 bbl., or about 3% more than the previous year.

"Stocks on hand November 1 were the highest for that date in history and one-fifth greater than a year ago. Substantial curtailment during the winter is inevitable.

"Capacity to manufacture continues to increase. At present it is about 200,000,000 bbl. per year. The additional capacity of ten new plants and enlargement of old plants practically assure a total capacity of 215,000,000 bbl. next year. This is 33% greater than this year's indicated consumption.

"In the last few years greatly increased storage facilities for both cement and clinker have been built, which in effect increase capacity. As the necessity of winter shutdown due to full stock houses is reduced, this large excess of capacity over demand presents a serious problem.

"Complicating it is the menacing increase of cement imports. Within five years importations have grown from practically nothing to an estimated 4,000,000 bbl. this year. Those who are in direct competition with this imported product need no reminder of it, but perhaps some in the interior of the country do not fully realize its size and importance. Nearly one-half of the cement consumption of the metropolitan district of Boston in the first nine months of this year has been of foreign cement.

"As late as May, 1922, when the proposed duty on cement was under debate in Congress, it was stated many times that no foreign cement except that from Canada could enter into competition with the American product; yet imports have jumped from about 325,000 bbl. that year to about 4,000,000 bbl. this year, with the peak not yet in sight With Europe's labor getting about one-fifth of the day's wage of American workers, with low transportation costs and light overhead charges, Europe is dumping here these large quantities of cement at prices which American producers cannot profitably meet.

We Should Insist on American Products for American Roads and Public Buildings

"Immediate tariff legislation is unlikely, but pending the time when congressional relief can be effected, government officials and national legislators should be made acquainted with the facts, in the hope that they will not permit the error of opinion of 1922 to prevail. We should show public officials what the menace of this foreign enterprise is and where American dollars are being expended for the construction of public buildings and roads we can rightfully

insist that specifications call for an American product. American taxes should be spent for American goods and foreign cement should be excluded.

"The American cement manufacturer is not the only one injured. A pamphlet recently published by one of our large cement manufacturers shows that American industry lost $29,000,000 through the importation of 10,000,000 bbl. of foreign cement in the last five years. This loss is borne not alone by the capital and labor in cement plants, but by American coal and oil industries, power companies, railroads, sack manufacturers, explosive and gypsum producers, machinery manufacturers and others. These facts should be made known to those who are fostering the use of foreign cement. We should influence buyers of the imported product to cease their patronage of foreign producers, not alone for patriotic consideration, but for sound business reasons as well."

In speaking of the work of the Portland Cement Association Mr. Smith stated:

"We have found out in our laboratories many things new to the engineering profession which have been distinctly helpful in improving the methods of using cement. Tests have been devised which are now applied quite generally in construction work of note which enables engineers to determine in advance the quality of concrete which they are to use.

"Another line of development of technical knowledge which is very much worth while is the study of the constitution of cement clinker. The policy on which this work is being pursued is characteristic of the studies which have been made of concrete, namely, to establish basic facts about cement and not to try to support any previously established opinions."

The convention was closed Wednesday evening with a banquet at the Drake Hotel, with Blaine S. Smith acting as master of ceremonies. George Woodruff, vice-chairman of the National Bank of the Republic, spoke on "The Possibilities for 1927." Col. Sidney D. Waldon, president of the Detroit Rapid Transit Commission, also delivered an interesting talk on "Untying the Traffic Knot."

Mr. Woodruff in speaking of foreign competition with American manufacturers declared:

Foreign Competition to Bring About Business Adjustment

"We should not fail to realize that European competition is slowly gaining and that while it can hardly hit us as hard in 1927, it will doubtless be the factor that will ultimately bring about our next great period of business readjustment. If America were still a debtor country, we might be able to maintain our prosperity on a basis of very high production costs for a long time to come, but the fact that we are now the greatest creditor nation in the world makes the cost of production in our country a serious matter. The world must henceforth pay large sums of money to America every year, and this can be done in but three ways —by sending gold, by sending goods or by sending stocks and bonds. We do not want more gold and foreign countries do not possess sufficient gold to send. Stocks and bonds will doubtless come in large amounts, but this cannot go on forever. Goods must then come our way, and the force of competition will be felt by us in foreign trade and here at home. Only through the tariff can we guide from our ports the goods that will do the greatest harm and let in the things that will hit domestic output least."

As Was to Be Expected

An Editorial in the Chicago Journal of Commerce

ONE of South Dakota's handicaps is her venture into public ownership. This is a result of that muddled form of radicalism which for a time expressed itself in some northwestern states.

As an example of what South Dakota has let herself in for, consider her state-owned cement plant, located at Rapid City. At the end of the first half of 1926, the plant had an undivided profit of $118,200.25, according to an official report. But a check-up by privately employed accountants has resulted in the assertion that $27,203.31 should be deducted, leaving undivided profits of $90,996.94.

Even if the official report is accepted, however, the cement plant's financial condition is scarcely happy. For as against the undivided profits of $118,200.25, the state must pay $154,050 as interest on bonds. Thus the plant fails by $35,849.75 to earn its bond interest.

If the unofficial accountants' report is accepted, the undivided profits are only $90,996.94, and the amount by which the plant fails to earn its bond interest is $63,053.06.

If a state is bound to go in for public ownership, there are few worse enterprises that can be picked than a cement plant. A cement plant is not a public utility. When owned privately it requires no more governmental supervision than the ordinary industrial enterprise. A state that owns a cement plant may just as logically own a steel mill or a shoe factory.

Obviously a state is not qualified to carry on such an industrial operation competently. The information that the South Dakota cement plant has failed to earn its bond interest is interesting, but it is not astonishing.

Highway Research Board Meets December 2 and 3

THE National Highway Research Board, division of engineering and industrial research of the National Research Council, will meet at Washington, D. C., December 2 and 3. The program will be of interest to everyone who is connected in any way with the building of highways. Among the reports especially interesting to producers of road materials are: Report of Committee on Structural Design of Roads, by A. T. Goldbeck, National Crushed Stone Association; Report of Committee on Character and Use of Road Materials, by H. S. Mattimore, Pennsylvania State Highway Department; Discussion on Concrete Materials, opened by Professor Abrams of the Portland Cement Association, and a Report of the Committee on Highway Finance, by Prof. H. R. Trumblower of the University of Wisconsin. The meetings are to be open to all persons engaged in or interested in any branch of highway engineering. A dinner will be given in the Hall of Nations of Hotel Washington on the evening of December 2.

Russian Cement Coming

IN a conspicuous position in the New York *Times* the other day appeared the following advertisement:

PORTLAND CEMENT
(Russian)
Builders! Contractors!

"Consignment of 20,000 bbl. just arrived New York. Can sell at very cheap price if disposed of immediately. Cement analyzed and conforms to specifications of American Society for Testing Materials."

The advertisement was signed by the Amtorg Trading Corporation, 165 Broadway New York City, the American commercial agency of the Russian soviet government and of "about 700 private concerns"—presumably all Russian—as it has described itself to a representative of the *Manufacturers' Record*, from which the above was taken.

Third Potash Exploration Area Designated

LOCATION of the area designated as third in order of availability for purposes of potash exploration in the course of the federal government's campaign to develop an independent American potash industry is announced by the Bureau of Mines as centering at the Mid-Kansas Harris Bros. No. 1 oil well, in the southeast quarter of Section 20, Block H-H2, Gulf, Colorado and Santa Fe railway survey, Crockett county, in central-western Texas. It is in a section temporarily abandoned for oil-prospecting purposes following the drilling of a number of dry holes. The top of the potash-bearing salt beds lies 1000 ft. below the surface. The maximum depth required for potash prospecting will probably be 2000 ft. Oil-well cuttings show excellent polyhalite. The well site is 25 miles south by road from Rankin, on the Kansas City, Mexico and Orient railroad in Upton county. It is permissible to drill the test hole within a radius of two miles.

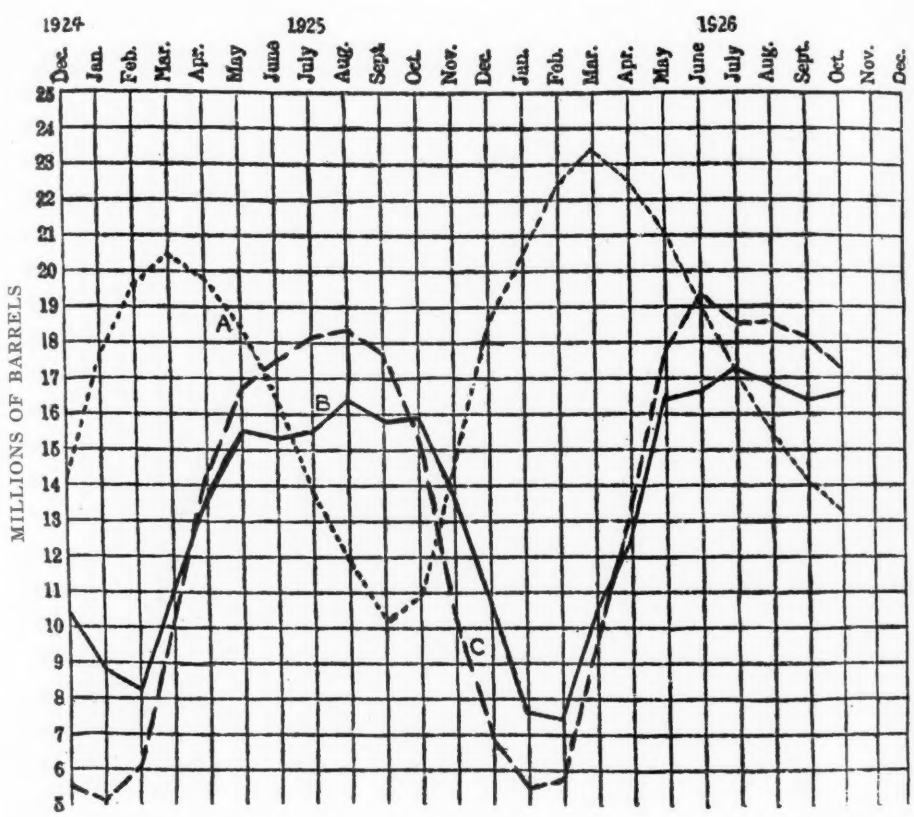
Portland Cement Output in October

Production Still High—Shipments Show Seasonal Decrease—Stocks Continue to Decline

PRODUCTION and shipments of portland cement in October, 1926, were the greatest for that month in any year, according to the Bureau of Mines, Department of Commerce. Production was at about the same rate as in September, 1926, and exceeded that of October, 1925, by nearly 4%. While a seasonal decrease is shown in the October shipments of portland cement, they were over 14% greater than the shipments in October, 1925. Portland cement stocks continued to decline, but at the end of October, 1926, were over 21% in excess of the stocks at the end of October, 1925.

These statistics, prepared by the Division of Mineral Resources and Statistics of the Bureau of Mines, are compiled from reports for October, 1926, received direct from all manufacturing plants except two, for which estimates were necessary on account of lack of returns.

MONTHLY FLUCTUATIONS IN PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT



(A) Stocks of finished portland cement at factories. (B) Production of finished portland cement. (C) Shipments of finished portland cement from factories

Clinker Stocks

Stocks of clinker, or unground cement, at the mills at the end of October, 1926, amounted to about 5,387,000 bbl. compared with 6,095,000 bbl. (revised) at the beginning of the month.

An estimate of the unground clinker by months is given below.

ESTIMATED CLINKER (UNGROUND CEMENT) AT THE MILLS AT END OF EACH MONTH, 1925 AND 1926, IN BARRELS

Month	1925	1926
January	7,017,000	9,074,000
February	8,497,000	10,931,000
March	9,962,000	12,284,000
April	9,731,000	12,934,000
May	9,053,000	11,649,000
June	7,937,000	10,086,000
July	6,961,000	8,515,000
August	5,640,000	7,362,000
September	4,561,000	*6,095,000
October	4,086,000	5,387,000
November	5,013,000	....
December	6,469,000	....

*Revised.

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped during the months of August and September, 1925 and 1926:

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES, IN AUGUST AND SEPTEMBER, 1925 AND 1926, IN BARRELS*

Shipped to	1925—August	—1926	1925—September	—1926
Alabama	277,605	173,619	192,882	153,636
Alaska	264	1,130	455	668
Arizona	33,328	45,553	34,380	42,709
Arkansas	88,143	71,312	54,377	75,962
California	1,154,523	1,165,387	1,120,092	1,204,615
Colorado	118,335	133,172	122,128	137,054
Connecticut	194,911	224,946	232,265	255,785
Delaware	50,949	35,287	63,024	46,600
District of Columbia	83,155	75,684	84,260	94,183
Florida	310,457	330,285	522,465	315,214
Georgia	136,542	188,201	134,340	160,377
Hawaii	1,108	8,895	3,511	17,179
Idaho	31,846	44,589	24,959	34,221
Illinois	1,790,148	1,806,425	1,658,700	1,458,052
Indiana	690,624	694,894	625,962	646,062
Iowa	375,407	412,046	368,763	350,251
Kansas	254,074	260,169	205,607	226,069
Kentucky	220,859	174,283	196,628	246,310
Louisiana	105,440	121,260	80,907	108,642
Maine	37,277	108,161	40,051	90,934
Maryland	235,983	208,790	260,019	249,489
Massachusetts	356,341	349,319	326,615	358,853
Michigan	1,194,934	1,567,764	1,195,566	1,372,831
Minnesota	472,018	437,014	455,011	407,570
Mississippi	70,141	80,109	56,979	79,924
Missouri	723,916	611,020	597,568	457,632
Montana	31,638	31,256	24,598	30,597
Nebraska	210,305	201,211	206,703	169,159
Nevada	12,635	9,088	10,598	10,291
New Hampshire	52,941	49,958	48,675	56,092
New Jersey	653,685	691,453	809,251	866,717
New Mexico	17,246	21,231	12,945	17,738
New York	2,151,191	2,329,217	2,006.604	2,490,511
North Carolina	340,027	376,779	354,835	412,719
North Dakota	37,735	43,493	33,458	46,528
Ohio	1,212,138	1,199,908	1,118,150	1,137,722
Oklahoma	286,912	236,223	195,542	219,399
Oregon	157,360	128,525	157,333	150,679
Pennsylvania	1,852,731	1,493,733	1,937,173	1,620,018
Porto Rico	0	0	346	0
Rhode Island	71,369	66,573	71,846	56,575
South Carolina	92,255	62,408	82,742	55,967
South Dakota	57,380	44,054	56,838	47,794
Tennessee	193,279	207,528	171,080	239,051
Texas	404,161	484,822	328,962	430,727
Utah	45,985	54,276	44,564	56,948
Vermont	23,698	49,660	28,794	50,697
Virginia	176,842	182,011	184,071	191,720
Washington	323,325	198,993	258,182	202,117
West Virginia	177,994	162,440	201,698	188,894
Wisconsin	626,004	715,784	513,479	594,999
Wyoming	31,042	24,901	20,461	23,893
Unspecified	10,520	70,497	74,427	73,748
	18,258,726	18,465,336	17,610,869	18,032,122
Foreign countries	124,274	70,664	100,131	54,878
Total shipped from cement plants	18,383,000	18,536,000	17,711,000	18,087,000

*Includes estimated distribution of shipments from three plants in August and September, 1925; from four plants in August, 1926; and from five plants in September, 1926.

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1925 AND 1926, IN BARRELS

Month	Production 1925	Production 1926	Shipments 1925	Shipments 1926	Stocks at end of month 1925	Stocks at end of month 1926
January	8,856,000	7,887,000	5,162,000	5,674,000	17,656,000	20,582,000
February	8,255,000	7,731,000	6,015,000	5,820,000	19,689,000	22,384,000
March	11,034,000	10,355,000	10,279,000	9,539,000	20,469,000	23,200,000
First quarter	28,145,000	25,973,000	21,456,000	21,033,000	....	....
April	13,807,000	12,401,000	14,394,000	12,961,000	19,877,000	22,640,000
May	15,503,000	16,472,000	16,735,000	17,951,000	18,440,000	21,173,000
June	15,387,000	16,827,000	17,501,000	19,113,000	16,409,000	18,900,000
Second quarter	44,697,000	45,700,000	48,630,000	50,025,000	....	....
July	15,641,000	17,096,000	18,131,000	18,786,000	13,896,000	17,210,000
August	16,419,000	16,936,000	18,383,000	18,536,000	11,952,000	15,718,000
September	15,939,000	16,571,000	17,711,000	18,087,000	10,247,000	*14,195,000
Third quarter	47,999,000	50,603,000	54,225,000	55,409,000	....	....
October	15,992,000	16,596,000	15,309,000	17,486,000	10,979,000	13,305,000
November	13,656,000	....	10,187,000	....	14,534,000	....
December	10,713,000	....	6,917,000	....	18,515,000	....
Fourth quarter	40,361,000	....	32,413,000	....	....	....
	161,202,000	....	156,724,000	....	....	....

*Revised.

PRODUCTION, SHIPMENTS, AND STOCK OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN OCTOBER, 1925 AND 1926, AND STOCKS IN SEPTEMBER, 1926, IN BARRELS

Commercial district	Production 1925—October	Production 1926—October	Shipments 1925—October	Shipments 1926—October	Stocks at end of October 1925	Stocks at end of October 1926	Stocks at end of September, 1926*
E'n Penn., N. J. & Md.	3,851,000	3,986,000	4,108,000	4,272,000	802,000	2,432,000	2,718,000
New York	916,000	999,000	977,000	921,000	411,000	674,000	596,000
Ohio, W'n Penn. & W. Va.	1,700,000	1,795,000	1,432,000	1,668,000	1,515,000	2,057,000	1,930,000
Michigan	1,171,000	1,338,000	1,062,000	1,385,000	815,000	1,015,000	1,062,000
Wis., Ill., Ind. & Ky.	2,339,000	2,160,000	2,014,000	2,656,000	2,153,000	1,296,000	1,792,000
Va., Tenn., Ala. & Ga.	1,254,000	1,430,000	1,236,000	1,391,000	283,000	1,068,000	1,029,000
E'n Mo., Ia., Minn. & S. Dak.	1,515,000	1,458,000	1,434,000	1,842,000	1,970,000	1,609,000	1,993,000
W'n Mo., Neb., Kans. & Okla.	992,000	1,032,000	972,000	984,000	1,518,000	1,455,000	1,407,000
Texas	429,000	428,000	335,000	444,000	382,000	401,000	417,000
Col., Mont. & Utah	270,000	275,000	200,000	252,000	487,000	406,000	384,000
California	1,189,000	1,381,000	1,201,000	1,359,000	458,000	480,000	458,000
Ore. & Wash.	366,000	314,000	338,000	312,000	185,000	412,000	409,000
	15,992,000	16,596,000	15,309,000	17,486,000	10,979,000	13,305,000	14,195,000

*Revised.

Manufacture of Portland Cement from Marl

THE Manufacture of Portland Cement from Marl, by Raymond E. Kirk, is Bulletin No. 4 of the engineering experiment station of the University of Minnesota. Like all the publications from this source that have come to the attention of ROCK PRODUCTS it is exceptionally well illustrated, printed and bound.

This is a revision of Bulletin No. 2 treating of the same subject which is important to Minnesota, as the state has no limestones fit for cement raw materials. There is a possibility that some of the marls found abundantly in some portions would do.

The book not only describes these deposits but lays out a systematic method of investigating more deposits to determine their value as cement raw material.

Tables showing the composition of marls and clays used as cement materials in various parts of the United States provide a comparison with Minnesota marls. To show why Minnesota limestones are unfit for cement making a table of limestone analyses is included. Without exception these show too high a magnesia content. The author admits that a suitable limestone may exist more probably in the southeastern portion of the state, but he does not think the chances for finding such a deposit are good.

Several pages are given to the process of making portland cement from marl as it is carried on in plants in other parts of the United States.

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES, AND BY DISTRICTS, IN SEPTEMBER, 1926

Imported from	District into which imported	Barrels	Value
Belgium	Galveston	5,892	$ 8,805
	Hawaii	18,540	24,514
	Los Angeles	11,605	14,634
	Maine and New Hampshire	9,008	8,400
	Massachusetts	48,308	68,940
	New York	36	150
	Oregon	5,951	8,426
	Philadelphia	47,605	101,267
	Porto Rico	3,986	7,206
	San Francisco	4,224	5,937
	South Carolina	3,003	4,216
	Washington	11,611	17,059
	Total	169,769	$269,554
Canada	Maine and New Hampshire	89	$ 287
	St. Lawrence	3,068	6,091
	Total	3,157	$ 6,378
Denmark and Faroe Islands	Porto Rico	9,848	$ 15,425
	Washington	2,383	3,356
	Total	12,231	$ 18,781
United Kingdom	Porto Rico	8,972	$ 13,511
	Grand total	194,129	$308,224

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1925 AND 1926

	Exports 1925 Barrels	Exports 1925 Value	Exports 1926 Barrels	Exports 1926 Value	Imports 1925 Barrels	Imports 1925 Value	Imports 1926 Barrels	Imports 1926 Value
January	71,596	$ 207,547	72,939	$216,431	231,258	$ 364,196	360,580	$576,717
February	56,249	181,356	73,975	220,706	119,077	206,308	314,118	527,948
March	65,248	200,410	69,080	205,647	218,048	337,039	493,241	812,963
April	89,508	263,831	96,296	284,772	197,686	280,826	257,302	398,114
May	85,385	250,845	78,601	224,365	186,897	286,959	223,130	337,031
June	71,343	217,899	80,684	248,814	254,937	409,539	335,570	495,744
July	98,141	286,543	130,822	370,220	335,118	499,602	250,862	395,981
August	103,961	289,904	64,946	216,489	379,847	611,551	350,638	560,532
September	102,649	285,225	70,920	239,174	513,252	789,121	194,129	308,224
October	73,369	228,467	....	....	535,050	824,268	....	....
November	101,825	294,201	....	....	388,604	678,518	....	....
December	100,323	296,900	....	....	295,543	526,001	....	....
	1,019,597	$3,003,128	....	....	3,655,317	$5,813,928	....	....

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII, AND PORTO RICO, IN SEPTEMBER, 1926*

	Barrels	Value
Alaska	2,869	$ 8,626
Hawaii	9,390	22,346
Porto Rico	4,365	9,950
	16,624	$40,922

*Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

EXPORTS AND IMPORTS*

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES, IN SEPTEMBER, 1926

Exported to—	Barrels	Value
Canada	1,167	$ 5,837
Central America	3,035	8,404
Cuba	5,502	13,568
Other West Indies	7,848	17,381
Mexico	10,662	31,599
South America	38,820	140,105
Other countries	3,886	22,280
	70,920	$239,174

RECAPITULATION STATISTICS FOR PRODUCTION, SHIPMENTS AND STOCKS OF PORTLAND CEMENT IN DISTRICTS RECENTLY DEFINED

	Production Colo., Mont. & Utah 1925	Production Colo., Mont. & Utah 1926	Production Ore. & Wash. 1925	Production Ore. & Wash. 1926	Shipments Colo., Mont. & Utah 1925	Shipments Colo., Mont. & Utah 1926	Shipments Ore. & Wash. 1925	Shipments Ore. & Wash. 1926	Stocks at end of month Colo., Mont. & Utah 1925	Stocks at end of month Colo., Mont. & Utah 1926	Stocks at end of month Ore. & Wash. 1925	Stocks at end of month Ore. & Wash. 1926
January	80,000	48,000	76,000	109,000	59,000	73,000	140,000	114,000	400,000	392,000	309,000	379,000
February	153,000	70,000	180,000	115,000	117,000	106,000	146,000	128,000	436,000	356,000	343,000	366,000
March	121,000	142,000	219,000	241,000	184,000	191,000	255,000	246,000	374,000	308,000	307,000	360,000
April	271,000	240,000	346,000	347,000	243,000	225,000	271,000	289,000	402,000	322,000	381,000	419,000
May	276,000	272,000	366,000	335,000	257,000	256,000	394,000	315,000	422,000	347,000	352,000	435,000
June	230,000	311,000	380,000	378,000	251,000	289,000	461,000	376,000	400,000	369,000	272,000	437,000
July	272,000	312,000	378,000	332,000	240,000	269,000	453,000	356,000	432,000	413,000	198,000	413,000
August	239,000	309,000	394,000	326,000	263,000	297,000	444,000	305,000	409,000	425,000	147,000	434,000
September	245,000	247,000	365,000	309,000	236,000	288,000	380,000	334,000	417,000	384,000	143,000	409,000
October	270,000	275,000	366,000	314,000	200,000	252,000	338,000	312,000	487,000	406,000	185,000	412,000
November	95,000	....	293,000	....	128,000	....	167,000	....	453,000	....	296,000	....
December	49,000	....	208,000	....	85,000	....	120,000	....	415,000	....	384,000	....
	2,301,000	....	3,571,000	....	2,263,000	....	3,569,000	....	....	....	....	....

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning November 22:

CENTRAL FREIGHT ASSOCIATION DOCKET

14448. **Crushed stone,** carloads, McVittys, O., to Columbia Park, O. (B. & O. R. R.) Present rate, 6th class; proposed, 135c per net ton.

14451. **Crushed stone,** carloads, Carey, O., to various points in Ohio. Present rates, 6th class; proposed rates (in cents per net ton):

To	Rate	To	Rate
Mt. Vernon	110	Baltimore	105
National Road	110	Black Run	115
Newark	110	Bremen	115
New Lexington	125	Clay Lick	110
Outville	105	Coolville	135
Pataskala	105	Dresden	125
Pleasantville	115	Frazeysburg	115
Rushville	115	Fredericktown	110
Somerset	115	Glenford	110
Summit	100	Guysville	135
Thornville	115	Hanover	115
Toboso	110	Junction City	115
Utica	110	Kylesburg	105
Vanatta	110	Millersport	115

14452. **Sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and gravel, carloads, Ginger Hill and Rupel, Ind., to Stevensville Jct., St. Joseph and Benton Harbor, Mich. Present rates—On classification basis, except $1.01 per ton applies to Stevensville, Mich., via another route per application of the intermediate rule.

Proposed (rates in cents per net ton):

To	Proposed
Stevensville, Mich.	102
St. Joseph, Mich.	102
Benton Harbor, Mich.	102

Route—Via N. Y. C. R. R., LaPorte, Ind., and P. M. Ry.

The provisions of Agent Jones' Combination Tariff 228 to not apply in connection with proposed rates.

14454. **Crushed stone,** carloads, Holland, O., to points in Ohio. Present and proposed rates (rates in cents per net ton):

To	Prop.	Pres.
Moline	60	80
Stony Ridge	60	80
Luckey	65	80
Pemberville	65	80
Woodside	65	80
Wayne	70	80
Hatton	70	80
Fostoria	70	80

Present rates from Holland, O., published in N. Y. C. R. R. Ohio L. S. 624. The provisions of Agent Jones Combination Tariff 228 to not apply in connection with proposed rates.

14460. **Sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica), also gravel, carloads, Noblesville, Ind., to Horton, Sheridan, Terhune, Kirklin and Cyclone, Ind. Present rate, 92c per net ton to Sheridan and Kirklin, Ind., 6th class to other points; proposed, 80c per ton of 2000 lb.

14461. **Crushed stone,** carloads, Sandusky and Marblehead, O., to Ohio. Present rates—On classification basis, except that from Marblehead, O., to Bryan, O., rate of $1.10 per ton as published in L. & M. R. R. Ohio 298. Proposed rates (in cents per net ton):

To	Rate	To	Rate
Athens	145	Ironton	165
Belpre	155	Jackson	155
Blanchester	145	Lancaster	125
Bryan	105	Latty	105
Cambridge	135	Logan	135
Cecil	115	McArthur	145
Celina	115	Marietta	155
Chillicothe	135	New Paris	145
Circleville	125	Ohio City	115
Crooksville	135	Portsmouth	165
Gallipolis	165	Sciotoville	165
Greenville	135	Van Wert	115
Hillsboro	155	Wellston	115
Hobson	165	Zanesville	125

The provisions of Combination Tariff 228 to not apply in connection with proposed rates.

14463. **Sand** (other than blast, engine, foundry, glass, molding or silica) and gravel, carloads, Star Brick, Pa., to Freesburg, N. Y. Present rate, 15½c; proposed, 90c per ton of 2000 lb. Route—Via P. R. R., Warren and N. Y. C. R. R.

14476. **Lime,** carloads, Kenova, W. Va., to Pennsylvania, Ohio, and West Virginia.

To	Prop.	Pres.
*Wheeling, W. Va.	15½	16
*Pittsburgh, Penn.	17	17½
Washington, Penn.	17	17½
Carnegie, Penn.	17	17½
Crafton, Penn.	17	17½
McDonald, Penn.	17	17½
Chester, W. Va.	17	17½
Bridgeport, O.	15½	16
Bellaire, O.	15½	16
*Martins Ferry, O.	15½	16
Steubenville, O.	15½	16
Tiltonville, O.	15½	16
Mingo Jct., O.	15½	16
Shadyside, O.	15½	16
Warwood, W. Va.	15½	16
Follansbee, W. Va.	15½	16
Wellsburg, W. Va.	15½	16

*Will also apply to points taking same basis as outlined in B. & O. R. R. Eastbound Guide Book, Agent Schubert's I. C. C. No. A4.

10233. **Sand and gravel,** from Ft. Smith, Ark., to stations on the C. R. I. & P. Ry. To establish the following rates in cents per 100 lb. on sand and gravel, minimum weight marked capacity of car, but not less than 80,000 lb., from Ft. Smith, Ark., to points shown below.

To C. R. I. & P. Ry. (Via Wister, Okla.)		To C. R. I. & P. Ry. (Via Wister, Okla.)	
Caston	5	Lutie	5½
Fanshawe	5	Wilburton	5½
Hughes	5	Holson	5½
Denman	5	Gowen	6½
Red Oak	5	Hartshorne	6½
Panola	5½		

Shippers are asking for the 9702 basis of rates to Rock Island points west of Wister, Okla., the same as now applicable to points east thereof, in order to compete with Poteau, Okla., a point having the benefit of the Oklahoma scale to points involved.

10238. **Sand and gravel,** from points in Oklahoma to points in Kansas. To establish the following rates in cents per 100 lb. on sand and gravel, carloads, minimum weight marked capacity of car, but not less than 80,000 lb. from and to points shown below:

	From			
To Kansas:	Byllesby, Okla. Rates	Ft. Gibson, Okla. Rates	Kriener, Okla. Rates	Verkney, Okla. Rates
Baxter Spgs.	8	8	8	8
Neutral	8	8	8	8
Columbus	8	8	8	8
Sherwin	8	8	8	8
Hollowell	8	8	8	8
Hoag	8	8	8	8½
Oswego	8	8½	8½	8½
Wykoff	8	8½	8½	8½
Stover	8½	8½	8½	8½
Altamont	8½	8½	8½	8½
Mound Valley	8½	8½	8½	8½
Turck	8	8	8	8
Scammon	8	8	8	8
Mackie J.	8	8	8	8
Mayer Mine	8	8	8	8
Cherokee	8	8	8½	8½
Mackie	8	8	8½	8½
Mammouth	8½	8½	8½	8½
McCune	8½	8½	8½	8½
Straus	8½	8½	8½	8½
Laneville	8½	8½	8½	8½
Parsons	8½	8½	8½	8½

SOUTHERN FREIGHT ASSOCIATION DOCKET

30124. **Limestone**, ground or pulverized, from Ladds, Ga., to Tuskegee, Ala. Combination now applies. Proposed rate on limestone, ground or pulverized, carloads, minimum weight marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Ladds, Ga., to Tuskegee, Ala., 221c per net ton, made on basis of proposed Georgia scale for application over trunk and short lines.

30128. **Sand and gravel,** from Arundel Siding, Ellerslie, Old Dominion Siding and Petersburg, Va., to Virginia and West Virginia points. It is proposed to eliminate the words "Returning to the mines" from the description on sand and gravel, as published on pages 57, 58, 59 and 60 of A. C. L. R. R. I. C. C. B2419, Virginia Points Tariff No. 3, the purpose being to clarify the description so that the rates will not be restricted to apply only on traffic moving to coal mining operations.

30135. **Limestone or marble,** ground or pulverized, from Buquo, Hot Springs, Fletcher, N. C., Knoxville, Mascot and Strawberry Plains, Tenn., to North Carolina points. The present rates on limestone or marble, ground or pulverized, carloads, minimum weight 30 net tons, from the origins named to the North Carolina destinations named below, were originally established on basis of using rate to base points, plus proportions acceptable to the Virginia and Carolina Southern R. R. Rates to the junctions have since been revised and the present through rates are not in line with the original basis and exceed lowest combination in most cases. It is therefore proposed to establish through rates which will reflect lowest combination, using rate to base points, plus proportions acceptable to the V. & C. S. R. R. Statement of present and proposed rates will be furnished upon request. The destinations involved are: Roslin, Campbell's Mill, Oakland, St. Paul, Smith Siding, Roziers, Powers, Bee Gee, Dundee, Tobermory, Duart, Tar Heel, Perth, Dublin, Berwick and Elizabethtown, N. C.

30171. **Sand,** from Memphis and Johnsonville, Tenn., to G. M. & N. R. R. stations. In lieu of combination rates, it is proposed to establish intrastate rate of 150c per net ton on sand, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Johnsonville and Memphis, Tenn., to G. M. & N. R. R. stations between Jackson and Middleton, Tenn., viz.: Mandy, Parkburg, Deanburg, Silerton, Pine Top, Hooker, Hornsby, Serles, Lacy and Stark, Tenn.

30183. **Crushed stone** and marble, and whitestone, powdered, from Brownson, Amauhee, Gantt's Quarry, Ala., Tate and Whitestone, Ga., to Olmstead Falls, O. In lieu of combination rates, it is proposed to establish the following commodity rates to Olmstead Falls, O.:

From Brownson, Emauhee and Gantt's Quarry, Ala.: On marble, crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight shall govern; and on marble dust, carloads, minimum weight marked capacity of car, except when cars are loaded to their visible capacity actual weight shall govern, 488c and 567c per net ton respectively.

From Tate, Ga.: On marble, crushed, in bags, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight shall govern, 452c; on marble, ground or pulverized, in bags, carloads, minimum weight marked capacity of car, except when cars are loaded to visible capacity actual weight shall govern, 477c per net ton.

From Whitestone, Ga.: On stone, crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight shall govern, 452c; on whitestone, powdered, carloads, minimum weight marked capacity of car, except when cars are loaded to their visible capacity actual weight shall govern, 477c per net ton.

Proposed rates are the same as in effect to Cleveland, O.

30207. **Gravel,** Camden, Tenn., to M. & O. R. R. stations. It is proposed to revise the present rates on gravel, carloads (no change in present description), from Camden, Tenn., to Mobile & Ohio R. R. stations in Mississippi, to be on basis of the proposed Georgia scale less 10%. The present and proposed rates to representative points are (in cents per net ton):

To	Pres.	Prop.
Corinth, Miss.	102	144
Tupelo, Miss.	102	158
West Point, Miss.	113	176
Macon, Miss.	113	176
Electric Mills, Miss.	113	180
Meridian, Miss.	113	185

30210. **Limestone** or marble, ground or pulverized, from Sparta, Tenn., to Henderson, N. C.

In lieu of combination basis, it is proposed to establish through rate of 243c per net ton on limestone or marble, ground or pulverized, carloads, minimum weight marked capacity of car, except when car is loaded to full visible capacity actual weight will apply, from Sparta, Tenn., to Hendersonville, N. C., made on basis of the proposed Georgia scale less 10%.

SOUTHERN FREIGHT ASSOCIATION DOCKET

30294. **Stone,** broken or crushed, from Franklin, Tenn., to Gallatin, Tenn. Present rate, 100c; proposed rate on stone, broken or crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight shall govern, from Franklin, Tenn., to Gallatin, Tenn., same as rate in effect from Franklin to Peytona, Tenn., i.e., 90c per net ton.

30297. **Lime,** from Burns, Tenn., to Erin and Palmyra, Tenn. It is proposed to extend the expiration date of the 110c per net ton on lime from Burns to Erin and Palmyra, Tenn., as published in Sup. "F" to Agent Glenn's Lime Tariff No. 7, from December 31, 1926, to July 1, 1927.

30319. **Crushed marble,** from Tate, Ga., to Chicago, Ill. It is proposed to amend the rate of 423c per net ton on crushed marble, carloads, from Tate, Ga., to Chicago, Ill., so as to apply via Louisville, Ky., without any restriction as to the routing beyond that point.

30356. **Limestone,** crushed, from Lime Rock, Fla., to Port St. Joe, Fla. In lieu of rate of 186c per net ton (River Junction, Fla., combination), it is proposed to establish through rate of 144c per net ton on limestone, crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight shall govern, from and to points named, proposed in order to enable Lime Rock, Fla., shippers to compete with shippers at River Junction, Fla.

30373. **Sand,** from Lumber City, Ga., to Live Oak, Falmouth and Ellaville, Fla. It is proposed to establish the following reduced rates on sand, carloads, minimum weight 90% of marked capacity of car, except where cars are loaded to visible capacity actual weight will govern, from Lumber City, Ga.: To Live Oak, Fla., 158c; to Ellaville and Falmouth, Fla,, 176c per net ton; made on basis of the proposed Georgia joint line scale, less 10%, which is the basis generally observed in constructing rates on sand between points in the South.

30376. **Lime,** from Denie, Ala., to Louisiana points. No commodity rates in effect and it is proposed to establish on lime, carloads, minimum weight 30,000 lb., from Denie, Ala., to all destinations in Louisiana shown in Agent Speiden's Louisiana Tariff, I. C. C. 981, from which specific rates are published on lime, carloads, from Chisca (Colbert county), Ala., the same as currently in effect from Chisca, Ala.

30379. **Sand and gravel,** from Montgomery, Ala., district pits on the L. & N. R. R. to Dickert, Hinley's Spur, Falmouth Mile Post 732 and Mile Post 739, Fla. It is proposed to establish rate of 189c per net ton on sand and gravel, in straight or mixed carloads, minimum weight 90% of the marked capacity of car, except when cars are loaded to their visible capacity actual weight will apply, from Montgomery District points on the L. & N. R. R., viz.: Jackson's Lake, Prattville Junction, Coosada and Oktamulkie, Ala., to the destinations named above, same as proposed in Submittal 29935 from Montgomery, Ala.

ILLINOIS FREIGHT ASSOCIATION DOCKET

2678B. **Limestone** or lime rock, broken, crushed or ground, carloads, minimum weight marked capacity of car, but not less than 80,000 lb., from Mosher and Ste. Genevieve, Mo., to Waukegan, Ill. Present rate, 265c; proposed, 255c per net ton.

3892. **Limestone,** unburned agricultural (in bulk, in open top cars only), minimum weight 90% of marked capacity of car, except when car is loaded to full cubical capacity, actual weight will apply, from Lehigh, Kankakee and Van's Siding, Ill. (N. Y. C. R. R. points), to Kansas & Sidell R. R. stations, viz.: Archie, Hildreth, Gordon, Jessie, Hume, Hughes, Payne, Brockton, Boston, Warrington, Nays and Kansas, Ill., also Westfield R. R. stations, viz.: Hites, Relief, Westfield, Oilfield, Briscoe and Casey, Ill. Present rate, 156c; proposed, 126c per net ton.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

11214. **Lime,** common, hydrated, quick or slack, and limestone chips or waste, minimum weight 40,000 lb., to Delano Jct., N. Y. from Cavendish, Leicester Jct., and New Haven Jct., Vt., 13, and from Danby, Vt., 12, via Rutland-D. & H. Co. Reason—To afford shippers an opportunity of reaching Delano Jct. on rate comparable to other points of destination.

11270. **Lime,** carloads, minimum weight 50,000 lb., from Ashley Falls, Great Barrington, Lee, Pittsfield, Sheffield and West Stockbridge, Mass., Canaan, Danbury, East Canaan, New Milford and Redding, Conn., to Haverford to Henderson, Penn., incl.; Whiteland to Lucknow Shop, Penn., incl.; Port Indian to Lytle, Penn., incl.; New Boston Jct. to St. Clair, Penn., incl.; Klines Groves to Tomhicken, Penn., incl.; Sunbury Shop to Montandon, Penn., incl.; Milton to Williamsport, Penn., incl.; Dauphin to Sunbury, Penn., incl.; Marysville to Duncannon, Penn., incl., 22½c; Juniata Bridge to Petersburg, Penn., incl., 23c; Barre to Altoona Oil Mixing Plant, Penn., incl., 23½c; Wildwood and Cape May, N. J., 25c, via Greenville Piers, N. J. Reason—To provide same rates as now in effect from Boston & Albany shipping points.

11281. **Stone,** broken or crushed, minimum weight 90% marked capicity of car, except when loaded to cubical or visible capacity actual weight will apply, to Poughkeepsie, N. Y., from Westfield, Mass., and Rocky Hill, Conn., $1.35 per net ton; from Thomaston, Conn., $1.20 per net ton; from New Britain and East Berlin, Conn., $1.30 per net ton; from Branford, East Haven, East Wallingford, Meriden and Mount Carmel, Conn., $1.25 per net ton. Reason—Not sufficient movement to justify continuance of rates.

10210. **Sand,** from points in Missouri to points in Oklahoma and Kansas. To establish the following rates in cents per 100 lb. on sand, carloads, minimum weight 90% of marked capacity of car, from and to points shown below:

From Crystal City, Mo., and Festus, Mo.

To—	Rates
Augusta, Kan.	14½
Blackwell, Okla.	15½
Henryetta, Okla.	15
Muskogee, Okla.	15
Okmulgee, Okla.	15
Oklahoma City, Okla.	17½
Sapulpa, Okla.	15
Tulsa, Okla.	15
Bristow, Okla.	15
Sand Springs, Okla.	15

Sand interests located at Crystal City and Festus, Mo., have been unable to successfully compete with Pacific, Mo., on Oklahoma traffic, the latter point having a rate of 13½c to point in the vicinity of Tulsa, Okla. The proposed rates from Crystal City and Festus are based 1½c per 100 lb. over the Pacific, Mo., rates, holding the 9702 scale as minimum.

10090. **Gravel,** from Hickory Creek, Okla., to Caney, Kan. To establish a rate of 5½c per 100 lb. on gravel, crushed stone and sand, carloads, minimum weight marked capacity of car, from Hickory Creek, Okla., to Caney, Kan. It is desired to publish via the Union Traction Co. the same distance rate as in effect from points on other lines in Oklahoma.

10098. **Sand and gravel,** between points in Southwestern territory. To establish a minimum weight 90% of the marked capacity of car on sand and gravel, carloads, between points in Southwestern Freight Bureau territory. It is desired to publish for application in Southwestern territory the same minimum weight as has been established for application in Central Freight Association, Trunk Line Association and Western Trunk Line Committee territory.

10115. **Sand and gravel,** between points in Louisiana and Texas. To revise rates on sand and gravel, between points in Louisiana and Texas, as outlined below:

(1) Confine the rates in Item 5480, also the rates in Column A on sand and gravel, of Item 5475, S. W. L. Tariff 21R, to apply only when consigned to county, state or municipal officers, for use in building good roads; also for building streets and for other municipal purposes and when the county, state or municipality pays the freight charges, i.e., where the benefit of reduction in rates accrues to the county, state or municipality and not the contractor.

(2) Publish for application from Louisiana stations on the G. C. & S. F. Ry., to stations in Texas on the G. C. & S. F. Ry., located in commodity Group P of S. W. L. Tariff 21R, the rates approved for application in the reverse direction on gravel; rock, crushed or ground; and sand, as per the above recommendation, in lieu of rates provided in Item 5480, Tariff 21R

(3) Substitute minimum weight of 80,000 lb. for the existing minimum weight of 50,000 lb. in connection with the rates on all articles in Item 5470B and on articles covered by Column B of Item 5475, S. W. L. Tariff 21R, which will result in minimum weight of 80,000 lb. or marked capacity of car, if less.

(4) Establish rate of 8c in lieu of 7c under Column "A" of Item 5470 B. S. W. L. Tariff 21R, for distance 175 and over 150 miles.

In view of the fact that the present basis of rates on the G. C. & S. F from Louisiana to Texas is less than that applicable locally within Texas, from Oklahoma to Texas and from Louisiana points on the Southern Pacific Lines and Gulf Coast Lines to Texas points on those lines, this change is suggested to remove the existing disparity and place the Santa Fe rates on the same level as the Southern Pacific and Gulf Coast rates.

10229. **Sand,** from Arkansas River, Okla., to Okmulgee, Okla. To establish a rate of 3c per 100 lb. on sand, as described in Item 290 of S. W. L. Tariff 55H, carloads, from Arkansas River, Okla., to Okmulgee, Okla. This rate is to enable movement of this commodity to Okmulgee for municipal purposes only at that point. The municipal officers in charge of this particular project for which this is to be used have petitioned for this rate and state that the benefit from same will accrue solely to the city of Okmulgee; that the present rate of 4½c will result in heavy cost and might cause serious delay and loss and also prevent carrying on the work.

10275. **Crushed stone,** from Williford, Ark., to points in Tenn. To establish the following rates per ton of 2000 lb. on crushed stone, carloads, minimum weight 90% of marked capacity of car, from Williford, Ark., to Tennessee points shown below:

To	Rates	To	Rates
Arlington	165	Springdale	145
Galloway	165	Leewood	145
Braden	165	Nat'l Cemetery	145
Mason	165	Wells	145
Keeling	165	Cedar Grove	145
Stanton	165	Bartlett	155
Shepards	175	Alturia	155
Big Hatchie	175	Glendale	155
Cuthbert	175	Brunswick	155
Brownsville	175	Pea Point	165

Shippers at Williford are endeavoring to secure contracts at points on the L. & N. R. R., Memphis Division, but have been unsuccessful in competing with east side quarries on present full Memphis combination basis.

10298. **Lime,** from points in Arkansas to points in Texas. To establish the following rates in cents per 100 lb. on lime, carloads, minimum weight 30,000 lb., from Limedale Spur and Ruddells, Ark., to Texas points on the P. & S. F. Ry. named below:

To	Rate	To	Rate
Miami	37½	Follett	39½
Codman	37½	Sherlock	39½
Hoover	37½	Darrouzett	39½
Pampa	....	Gaylord	39½
Kingsmill	38½	Booker	39½
White Deer	37½	Huntoon	39½
Cuyler	37½	Twichell	39½
Panhandle	37½	Perryton	39½
Lee	37½	Lord	39½
St. Francis	37½	Farnsworth	39½
Folsom	37½	Waka	39½
Amarilla	37½	Spearman	39½
Canyon	43	Higgins	34
Lester	44½	Coburn	34
Wilsey	45	Glazier	34
Abell	39½	Clear Creek	34
Pomeroy	....	Canadian	37½
McBride	39½	Isaacs	37½
Hillard	39	Mendota	37½
Isom	39½	Lora	37½
Magoun	39½		

It is desired to place Ruddells and Limedale Spur, Ark., on a competitive basis with rates from Johnsons, Ark.

10333. **Stone,** from points in Arkansas to interstate points. To establish the following rates in cents per 100 lb. on stone, crushed or broken, carloads, minimum weight 80,000 lb., or if marked capacity of car is less than 80,000 lb., marked capacity of car will govern, from and to points shown below:

To—	From—Magness, Ark. Rates	Cotter, Ark. Rates
Grand Rapids, Mich.	485	515
Detroit, Mich.	485	515
Toledo, Ohio	485	515
Columbus, Ohio	485	515
Cincinnati, Ohio	430	460
Cleveland, Ohio	600	630
Fort Wayne, Ind.	450	480
Indianapolis, Ind.	405	435
Louisville, Ky.	430	460
Pittsburgh, Penn.	630	660
Buffalo, N. Y.	630	660

The above adjustment is necessary, it is stated, in order to enable the movement of this commodity to points in Central Freight Association territory in competition with the production from points in the southeast.

10337. Lime, from points in Missouri and Arkansas to interstate points. To establish rate of 50½c per 100 lb. to Baileyvue, Neb., and 52c per 100 lb. to Lyman, Neb., and Huntley, Yoder, Veteran, Cottier, South Torrington, Wyo., from Missouri and Arkansas points named in Group 1 of St. L.-S. F. Tariff No. 69K, rates from Group 2 points to be made the usual differential of 1½c per 100 lb. over Group 1, on lime, carloads, minimum weight 30,000 lb. The proposed rate to South Torrington is the same as now applicable to Torrington, Wyo., on the C. B. & Q. R. R. As these two points are in direct competition, both carriers and shippers request that they be put on the same basis. The South Torrington basis is applied at intermediate points except Baileyvue, which, being only six miles from Haig, Neb., is put on the Haig basis.

Book Reviews

Richard K. Meade's Book on Portland Cement

Reviewed by D. C. FINDLAY
Industrial Engineer, Allentown, Penna.

PORTLAND CEMENT, Its Composition, Raw Materials, Manufacture, Testing and Analysis. By Richard K. Meade, M. S. Third Edition. Published by the Chemical Publishing Co., Easton, Penn., 1926. Also by Williams and Norgate, 14 Henrietta street, Covent Garden, London W. C., and Maruzen Co., Ltd., 11-16 Nihonbashi Tori-Sanchome, Tokio, Japan.

THE third edition of Mr. Meade's book has recently been released, and is a volume of 700 pages, profusely illustrated, with the text rewritten, and brought up to date. It is written in a very clear and concise form, and should serve as a class textbook for the student, as well as an authoritative source to which the busy chemist, superintendent, or engineer may turn for information on any specific subject, since it is well indexed making it easy to locate any information desired.

Instead of attempting a resume, which is hardly necessary as the pages of contents gives this in concise form, it may be of interest to emphasize a few of the author's statements and conclusions for the benefit of the reader, to help him in getting the most out of the book.

After going extensively into the nature and composition of portland cement, it is brought out that the important elements of cement so far as hardening goes, are tricalcium silicate, and dicalcium silicate, and that alumina compounds are needed only as a flux, and are of themselves of doubtful value aside from this.

American cements today are better than ten years ago, due to improved mechanical appliances rather than to any new ideas of how to make portland cement.

This is attributed to introduction of improved grinding machinery, making it possible to grind the raw materials to a fineness of 95 to 98% passing the 100-mesh sieve and assuring the manufacture of high-limed, sound cement of great strength.

Emphasis is laid on the necessity of absolute control of the chemical composition of the mixture fed to the kilns to assure cement of uniform high quality.

The routine tests of the mill laboratory are usually post mortems rather than diagnoses and are of no value so far as correcting the composition of the particular lot of raw material under examination is concerned, but they serve as a guide to the making of succeeding lots. The author stresses the need of "blending silos" in dry process plants, between the mills and the kilns, arranged so that the contents of two or more may be mixed by the screw conveyor feeding the kilns, and in this manner the dry process may be made to approach the wet process in its greater ease in blending the mix in the form of slurry.

To the list of mills available for preliminary grinding of materials, either rock or clinker, may be added the new Bethlehem mill, developed last year by the Bethlehem Foundry and Machine Co. A very complete general description is given in Chapter VII of the methods and machinery used in the manufacture of cement by the dry process, followed by a similar description of the wet process.

Local conditions vary in every mill of either type, but his conclusion is that the power equipment installed per barrel of cement produced is fully as large in wet process as in dry process plants.

Chapter XI and XII, on The Rotary Kiln, discuss the various reactions in a dry or wet kiln in a very complete manner, and although his conclusion is that it is probable that present practice has seen the limit in length for kilns of the diameter now in use, since this book was written there are several kilns being built which are to exceed 300 ft. in length, and are to have their coolers integral with the kiln.

It will be interesting to know the reaction of the operators of wet process mills to the author's assertion that there is nearly, if not quite, as much dust loss from the stacks of wet process kilns as from dry.

This question of dust losses is always a controversial one, and it may be of interest to cite the reviewer's experience, in the case of three old dry process mills which were converted to wet, and of one new wet process mill with a 9 and 10 ft. by 210 ft. kiln.

The first mill was near Victoria, B. C. and the owner complained of the dust ruining his garden, and home; after conversion to wet process, on the same materials, his gardens became the show spot of Vancouver Island although they were less than 1000 ft. from the kiln stacks.

Another mill, in Nebraska, was forced to shut down by unjunction due to the dust nuisance; after being rebuilt, and modern wet process kilns installed this same property holder became the company's best friend, as there was hardly a trace of dust on the corn fields within 200 ft. of the stacks.

A third mill, in Washington, was likewise satisfactorily converted, and a new wet process mill in Oregon has the kilns within 1000 ft. of the postoffice in the village, and causes no nuisance.

In each case there were inverted V-shaped lifters installed in the feed end of the kilns, and in front of them channel iron lifters riveted to the shell for about 30 ft. These lifters caused the wet slurry to be raised, and showered from one to the other, and presumably exposed so much wet surface to the gases that a major portion of the dust particles were trapped on the surfaces, and even though large settling chambers were also provided between the kilns and the stacks there was very little precipitation in them.

This type of lifter is not new, as the reviewer first saw them in kilns furnished to F. L. Smidth and Co. design, some 16 years ago.

An interesting paper has recently appeared in the June 11, 1926, issue of *Engineering* (London, England), describing a new method of feeding slurry to the kilns of Messrs. Greaves, Bull & Lakin, Ltd., Harbury, Leamington, England, in which the slurry is sprayed into the kilns through three adjustable nozzles, under about 70 lb. pressure, and is thus forced into the kilns some distance, and in a finely divided state. The claim is made that the process has almost completely eliminated the dust from escaping, and also that the process permits shortening the kilns appreciably for the same output or increasing the output for the same length of kiln.

This process has been developed since Mr. Meade's book was written, and is only one of numerous instances of the recent rapid progress of the art of making better cement.

The successful use of the Aero pulverizer for firing kilns and eliminating the usual coal drying department is an interesting development and tends to simplification of the kiln room.

The chapter on power equipment gives descriptions of actual installations in several modern mills and is a good guide to modern practice, although every engineer has his own pet ideas of the best type of machine; hence one never sees two mills built exactly alike.

The chapter on analytical methods, and analysis of cement mixtures, slurry, raw materials, physical testing, determination of specific gravity, fineness, soundness, tensile strength, etc., will be of great help to the chemist, and to anyone seeking information as to best practice in determining any of the various standard tests to which a sample of cement is subjected.

Mr. Meade's book is an outstanding contribution to the literature on portland cement, and should find a place in the library of every cement mill chemist, superintendent, engineer, or anyone having anything to do with the testing and making of cement.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

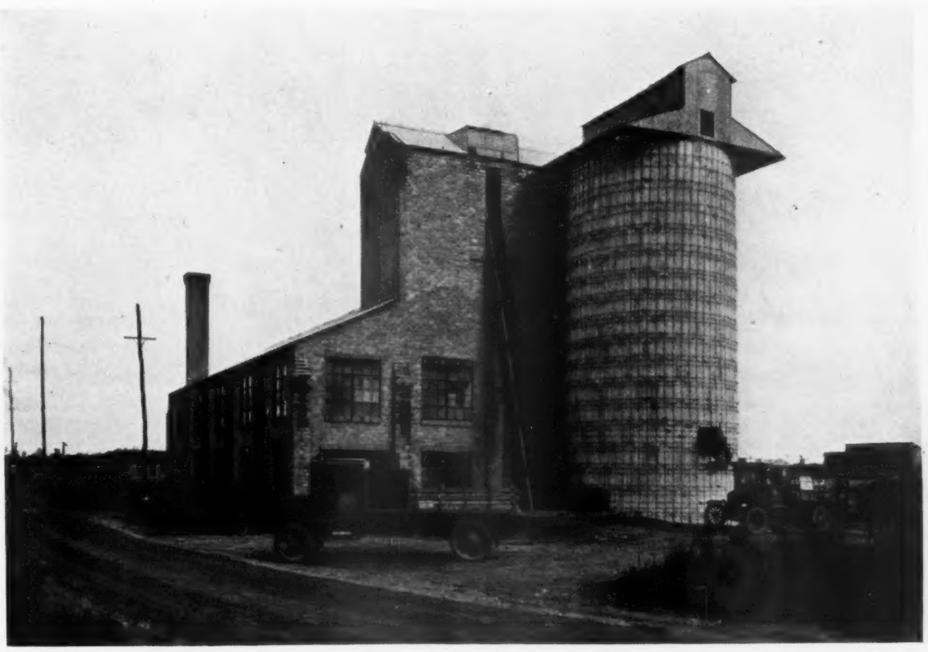
Find Good Profits in Stone Screenings

Making Concrete Products at Plant of LeRoy Lime and Crushed Stone Co.

By Wallace R. Harris
Of Eberling Machine Sales Co., Cleveland, Ohio

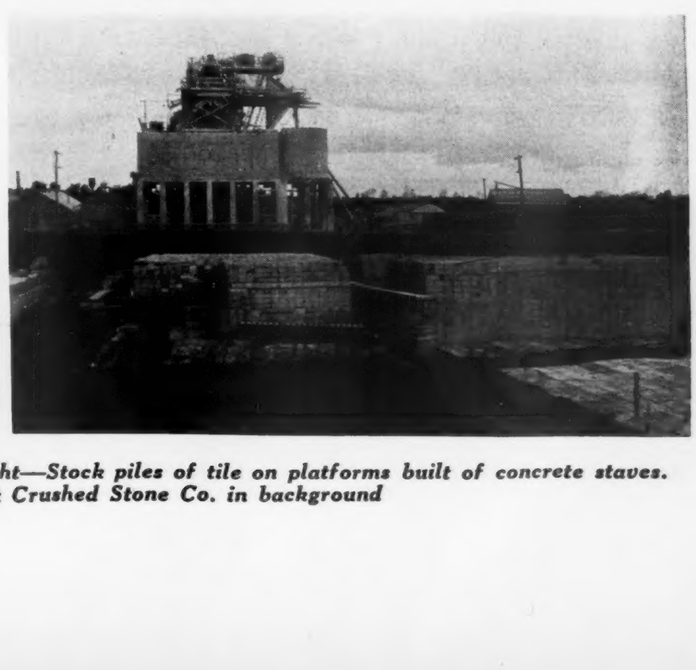
INDUSTRIAL efficiency demands that the wastes of yesterday be turned into profits today. Producers of crushed stone, sand and gravel are commencing to realize that their waste fine materials can be turned into marketable products. Fine aggregate converted into concrete products will yield a much greater profit per ton than is obtained per ton of coarser material.

That success will be the reward for those of vision and perseverance is indicated by the accomplishments of George E. Priest of Batavia, N. Y., who 10 years ago was engaged in the sale of farm lands. Mr. Priest saw that many acres of wet lands could be reclaimed by drainage and that concrete drain tile was becoming popular among farmers because of its excellent properties. At that time I was engineer of the Cement Products Bureau, Portland Cement Association. Mr. Priest called on me and obtained information regarding the manufacture of concrete drain tile and equipment for this purpose. He bought a Dunn tile machine and established a factory in 1917 at Batavia, which he operated for two years. The aggregate was supplied by the Batavia Sand Co., for which company Mr. Priest was acting as general manager.



View of factory buildings and 900-ton silo for storage of limestone screenings

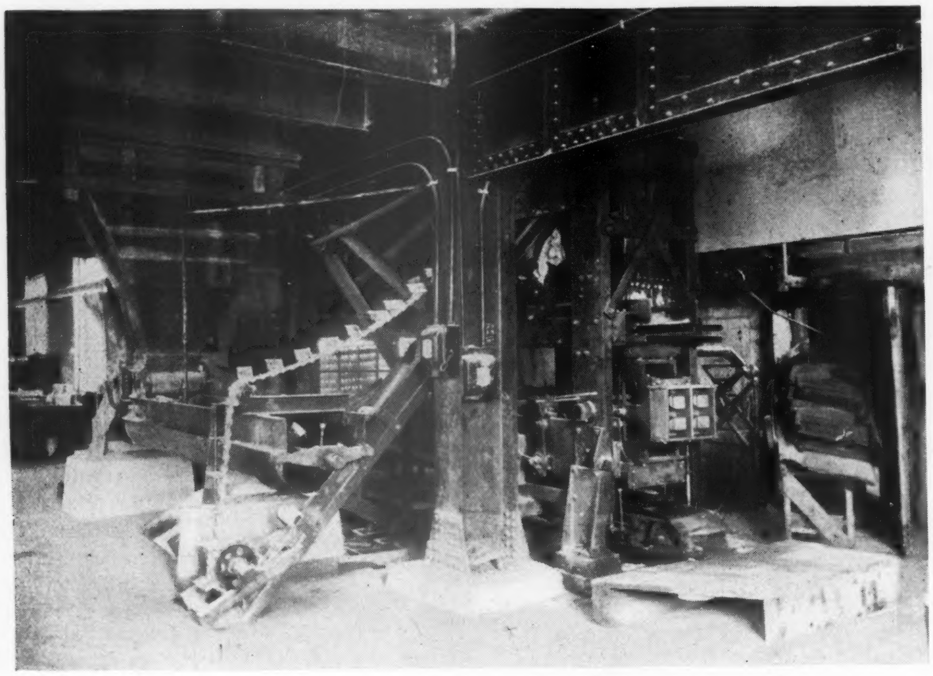
In selling drain tile Mr. Priest continued to study the needs of the farmer and saw the possibilities in manufacturing concrete staves for silos. He acquired the rights to manufac-



Left—Rear view of plant as seen from the storage yard. Right—Stock piles of tile on platforms built of concrete staves. Screening plant of Le Roy Lime & Crushed Stone Co. in background

ture the Playford Rib-Stone stave in a number of New York counties. As time passed additional territory was acquired. Today "Rib-Stone" staves are in use throughout New York state and in adjoining states. Stave manufacture was started in Batavia in 1921, at which time Mr. Priest organized the Rib-Stone Concrete Corporation.

In 1922 a Blystone tile machine was purchased and the manufacture of building tile started. In 1923 Mr. Priest saw the wisdom in being near an adequate supply of aggregate and moved his equipment to a site adjacent to the quarry of the Le Roy Lime & Crushed Stone Co. The aggregate used is limestone screenings which until then were a waste product of the quarry.



A corner of the machine room showing machines and accessory equipment

As the demand for staves and building tile continued to develop, it was decided to erect a new factory building and in the spring of 1925 the factory shown in the pictures was completed.

The factory consists of the main two-story building 50 by 100 feet in area with a third story at one end. Four steam curing rooms 8 ft. 6 in. by 84 ft. extend from the yard end of the building. The third floor contains two material bins each of 80 tons capacity. The silo beside it has a capacity of 900 tons.

The building is highly fire resistant as the walls are of concrete building tile, the floors are of reinforced concrete 4 in. thick where light loads are stored and 6 in. thick where heavy loads are stored. Heavy structural steel beams and girders support the concrete floor slabs which are reinforced with National steel fabric. Floor beams are supported by pilasters. The roof framing is steel and the roofing consists of cement-asbestos corrugated sheets made by the Asbestos Shingle and Slate Co., Ambler, Pa.

Curing rooms are built with concrete tile walls and arched roofs of reinforced concrete. The outer surface of the roof is flat. Space between the exposed flat surface and the inner arched structure is filled with cinders. These rooms are efficient in that loss of heat is reduced to a minimum. Steam is used in closed coils to give a dry heat. To get the desired degree of humidity, additional steam piping is used in troughs filled with water.

Automatic control of temperature and humidity is attained by instruments supplied by the Taylor Instrument Co. of Rochester, N. Y. Humidity is maintained at a point just below saturation. Recording thermometers are used to record temperatures. Steam curing is carired on for 24 hours for each day's run of products. Temperature in the curing rooms ranges from 130 to 140 deg. F. In winter 2½ hr. time is taken to build up the temperature to 120 deg. F. In other words, products are not immediately subjected to the maximum temperature. Time is required to warm up the products to the maximum temperature. The wet steam pipe is 1½ in. in size and contains 1/16 in. perforations on 18-in. centers.

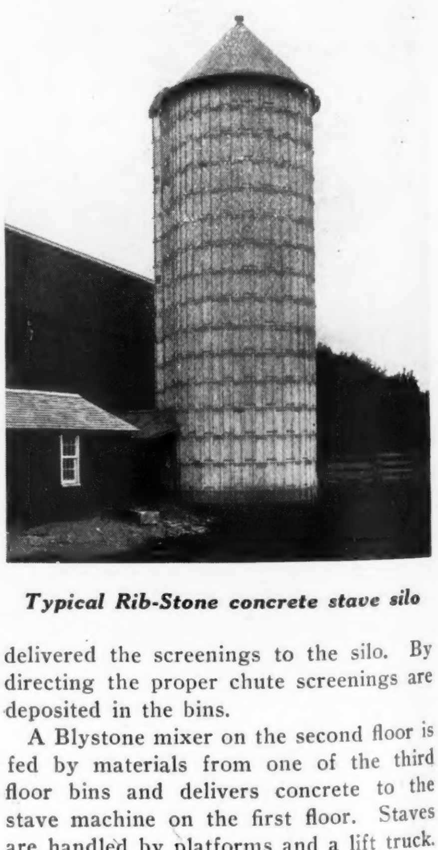
Steam is supplied by a 50-h. p. vertical boiler designed for 150 lb. pressure. The safety valve is set to blow off at 15 lb. above this. The boiler is located in a corner of the factory and separated by a tile wall enclosure.

Tool room and a supply room are located on the first floor.

The plant is conveniently located two miles from Le Roy and about 1000 ft. from New York State Route No. 5. A well paved road leads from the highway to the quarry. Three main line railroads pass the plant, the Erie, N. Y. C., and the B. R. & P. An interchange is in effect with the Pennsylvania System, D. L. & W., and the Lehigh system. Other railroads available for shipment of the products are the C. R. R. of N. J., B. & M., P. & R. and the Rutland.

At present all cement is received in cloth bags by railroad. Bags are loaded onto platforms that are hoisted from the car floor level to the second floor of the plant by a Shepard electric "Lift-About" hoist and carried on a trolley beam to the interior of the building, where a Barrett lift truck conveys the platform to the storage space. Twenty bags of cement are handled at a load at a cost of 1 cent per bag. The bagged cement remains on the platforms from the time it leaves the car until it is to be used in the mixers.

Limestone screenings are delivered from the quarry by 5-ton White motor trucks which dump the screenings into the boot of a bucket elevator which can be seen in the picture. This elevator by means of chutes delivers the screenings into the 900-ton silo or into two storage bins on the third floor to which reference has been made. From the silo, screenings can be delivered through a chute into motor trucks. When it is desired to replenish the store of screenings in the third floor bins, aggregate is delivered by gravity into the boot of the same bucket elevator that



Typical Rib-Stone concrete stave silo

delivered the screenings to the silo. By directing the proper chute screenings are deposited in the bins.

A Blystone mixer on the second floor is fed by materials from one of the third floor bins and delivers concrete to the stave machine on the first floor. Staves are handled by platforms and a lift truck. All staves are reinforced in the body with

2x4-in. steel mesh. The ribs are reinforced with ¼-in. steel rods. Staves are 2 in. thick in the body and 4 in. thick through the ribs and the ribs are 4 in. wide. The mesh used weighs 2 lb. per sq. yd. and is made by the National Steel Fabric Co.

Concrete is mixed to an easily working consistency. Each stave is vibrated, taken to the curing room and then surfaced on the exposed side.

Recently the company installed a complete Eberling system for the manufacture

Observation tower built for Donald Woodward of concrete staves and tile

of concrete building tile, consisting of a No. 10-A continuous mixer, an automatic tile machine and the Eberling cable conveyor system for handling green products and empty pallets.

One of the pictures is an interior view of a small part of the work room on the first floor. On the extreme left will be seen an Eberling continuous mixer equipped with two hoppers each having two compartments for materials. This permits the use of cement and three grades of aggregate. Cement is emptied from bags into a hopper on the second floor and descends by gravity through a 4-in. pipe. Limestone screenings are taken from one of the two bins on the second floor, passed through a set of Hummer screens, separated into two sizes and delivered to small storage bins on the floor on which the mixer is placed. Later, if it is found advisable, the screenings will be divided into three grades and delivered by gravity to the several divisions of the mixer hoppers.

Automatically cement and aggregate are measured accurately, by the feeding device on the mixer, and cascade together into the mixer barrel where 48 paddle tips thoroughly mix the materials into a uniform consistency concrete. This is delivered to the simple ladder conveyor visible in the left foreground of the picture. The conveyor passes behind the steel column to a point above the hopper on the Eberling tile machine.

The tile machine contains a rotor on which four mold boxes are mounted. Each mold box in turn comes into position under the charging pan which takes concrete from the machine hopper and feeds it, from both sides, in three charges into the mold box. Each charge of concrete is tamped and this mold box is rotated a quarter turn of the rotor to a position in front of the machine operator who places a pallet on the mold box. The filled mold box with its pallet is rotated another quarter turn of the rotor and the tile in the mold box with the pallet are ejected and deposited gently onto a conveyor which carries the loaded pallets to offbearers who take the pallets and stack them eight high on the cable conveyor. Every 10 seconds a pallet is carried from the machine.

Smoothly and noiselessly with no sign of vibration the conveyor moves forward until the conveyor flight is entirely loaded, then the next flight of conveyor is loaded. When tile are ready to be taken from the curing room and placed in the storage yard a flight of the conveyor is started and a man or two takes the loaded pallets, dump the tile on a roller conveyor and place the empty pallet on a pallet return conveyor. At the right of the tile machine may be seen the end of the pallet return conveyor with empty pallets ready for the operator.

A record is kept of stock piles according to age and the oldest tile are delivered as orders are received. Tile are shipped to any point in New York and New Jersey. Staves are shipped throughout New York, the New England and Middle Atlantic States. Staves are used for building silos, coal pockets and industrial tanks of various kinds.

Within a radius of 20 miles, products are deliverd by motor trucks. A 5-ton White motor truck and a 1-ton Ford provide a flexible delivery system. In addition to its own trucks, the company uses motor trucks of outside firms who haul 60% of the products made.

Three crews of from four to six men are engaged in the construction season erecting silos and one crew of from four to six men builds coal pockets and industrial tanks. A crew of 20 men is used in the manufacture of staves and tile.

Aggregate used is of excellent quality. That high strength concrete is obtained is indicated by the results of a test made by the Case School of Applied Science, Cleveland. The test was made on three tile produced by the Eberling tile machine from concrete mixed in an Eberling mixer. Proportions of the concrete materials was 1 part cement to 7 parts Le Roy limestone screenings. The test was made at the age of 38 days. The results are as follows:

No.	Dry weight	Weight after 48 hours in water	Area tested in sq in.	Total load in lb.	Per cent Absorp.	Unit compressive strength lb./sq. in.
1	21 lb. 9 oz.	22 lb. 9 oz.	54.6	135,500	4.6	2,482
2	21 lb. 7 oz.	22 lb. 11 oz.	54.6	137,670	5.8	2,521
3	21 lb. 7 oz.	22 lb. 10 oz.	54.6	138,040	5.5	2,528
				Average........	5.3	2,510

Rib-Stone concrete tile have been used to back up brick in a mansion estimated to cost more than a half million dollars, for a cold storage plant, a laundry, canning factories, garages, milk and apple evaporation plants, fruit packing plants, motion picture theaters, a bank building, service stations and in the Genesee county building now under construction. These are but a few of examples of where concrete tile are being used. Of the plant's output 90% has been used above the ground line and 80% has been used without any facing.

The observation tower built for Donald Woodward is on the highest spot in Genesee county. The tower is built of Rib-Stone staves and the adjoining building of tile and staves. While the tower was under construction a terrific wind occurred and although the steel bands were not tightened to the final limit, no damage resulted.

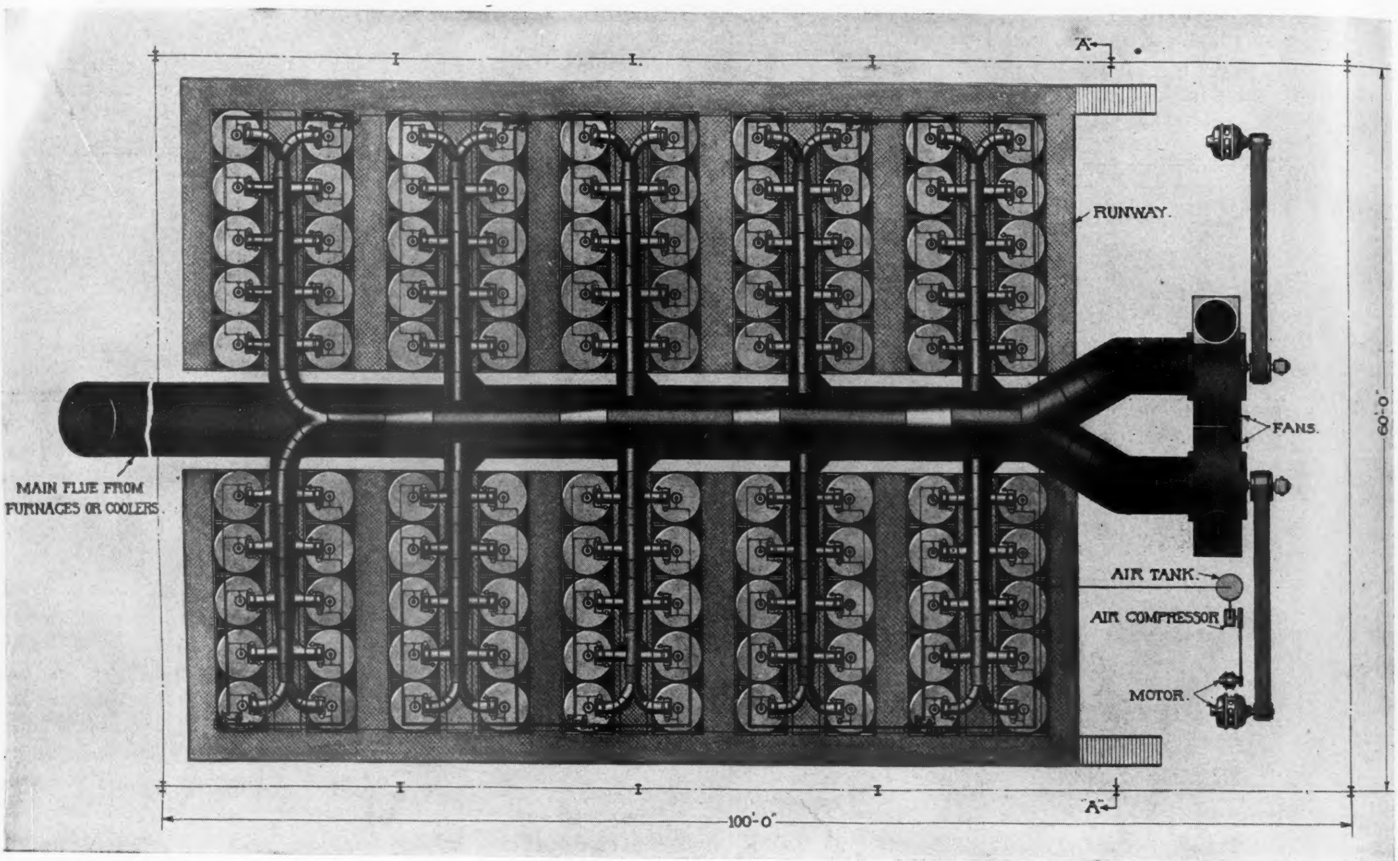
Indicating the development of the Rib-Stone Concrete Corporation's business, the following figures are given: Assuming as a basis that the business done in the first year was 100%, then the percentages will be understood. For silo staves, 1921, 100%; 1922, 50% (financial depression affecting farmers); 1923, 75%; 1924, 100%; 1925, 175%; 1926, 235% at close of season. Construction of coal pockets, grain elevators and other industrial tanks: 1923, 100%; 1924, 300%; 1925, 700%; 1926, 1700%.

Building tile: 1922, 100%; 1923, 250%; 1924, 400%; 1925, 600%. Figures not yet available for 1926.

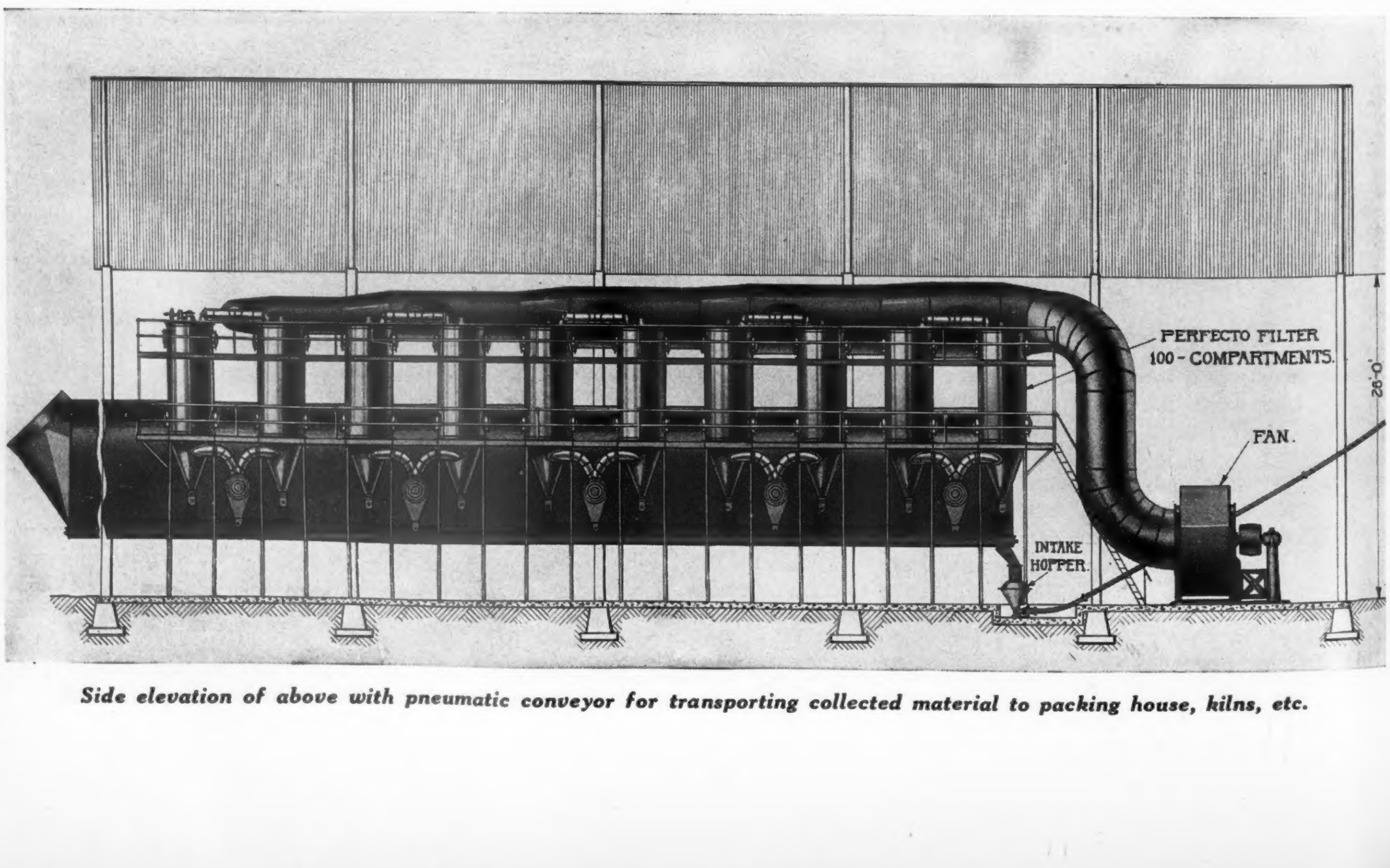
Officers and staff of the Rib-Stone Concrete Corp. are: George E. Priest, president and general manager; J. L. Heimlich, vice-president; Pauline E. Priest, secretary; Donald Woodward, treasurer; Harold J. Weinke, sales manager; Harry Russell, office manager; Frank Caswell, plant superintendent, and Carl Hansen, superintendent of silo, coal pocket and tank construction. Mr. Heimlich is also president of the Le Roy Lime and Crushed Stone Co.

The tile equipment which is in use at the Rib-Stone plant has a guaranteed capacity of 5000 5x8x12-in. hollow concrete building tile or 10,000 5x4x12-in. hollow concrete building tile in a 9-hr. day. This means the utilization of 50 or more tons of concrete a day.

New Machinery and Equipment



Plan of 100-compartment dust recovery plant. The arrangement shown consists of 10 banks each containing 10 filter compartments. There are 18 filter bags in each compartment, making a total of 1800 for the system

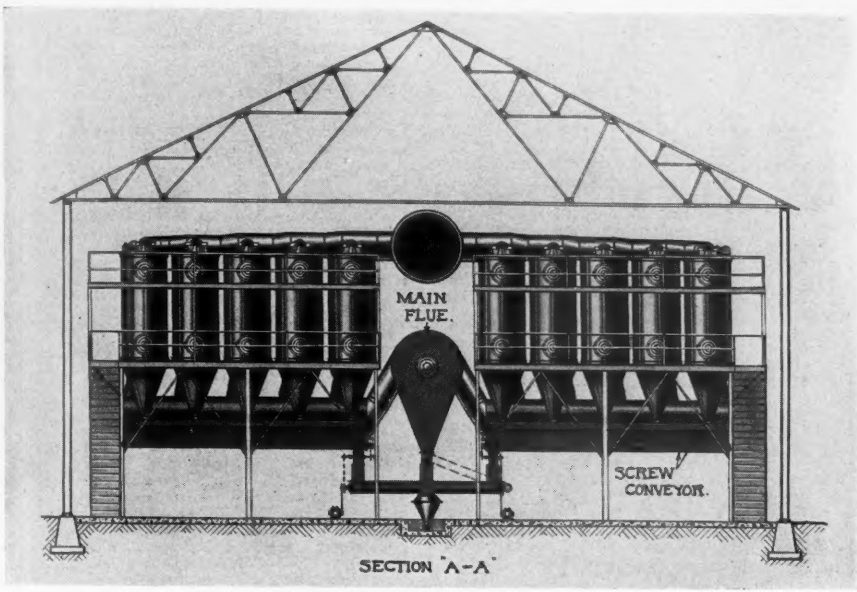


Side elevation of above with pneumatic conveyor for transporting collected material to packing house, kilns, etc.

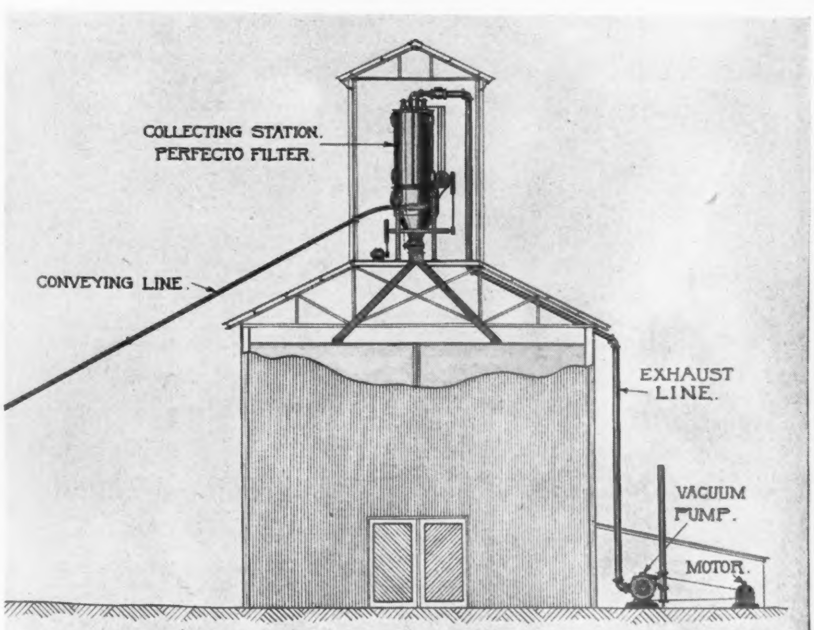
Dust Recovery and Conveying System for Cement, Lime and Gypsum Plants

THE "Dracco" dust recovery and conveying system is a form of baghouse combined with a pneumatic conveyor and is said to be suitable for cement, lime or gypsum operations. The installation as shown in one of the accompanying illustrations consists of 100 filter compartments arranged in 10 banks with 10 filter compartments in each bank. These compartments are known as Type AA. Each compartment has 18 filter bags. The total filter cloth area of the installation as pictured is approximately 32,000 sq. ft. The filter cloth is of densely woven cotton or woolen cloth, depending on the nature of the gases to be filtered.

Slides, or dampers, in the intake manifolds allow any of the 100 compartments or any of the 10 banks of filters to be shunted off the circuit without disturbing, it is said, any other part of the operation. If, for example, a bag starts to leak it can be seen on the fan discharge and the compartment containing the bag found by shutting the slides one at a time; the fan discharge getting clean when the slide on the compartment containing the damaged bag is closed. When found, the outlet from the compartment is also closed and the doors opened and the damaged bag discovered and replaced within a short time. In the event of a spark entering the compartment, only the 18 bags in that compartment, it is said, will burn and these may be replaced within a few hours without interrupting the operation of the remaining compartments.



End view of 100-compartment dust recovery plant



End view of collecting station

The installation referred to shows the filters erected on structural steel supports and screw conveyors which remove the material constantly from the coolers, manifolds and filters. The company recommends a "Dracco" pneumatic conveying installation for taking the constantly discharging material to storage warehouse or packing bins. The system, as shown, will filter, it is said, from 100,000 to 125,000 cu. ft. of gas per minute with a manufacturer's guaranteed efficiency of not less than 99½%. This means that from 3 to 4 cu. ft. of gas pass through each square foot of the filter surface each minute and this, it is said, is approximately six or seven times the volume that good practice allows in the old style baghouse. The filter cloth, it is said, is automatically kept clean and this insures a uniform draft condition. The allowable temperatures in the filters are not over 250 deg. F. if woolen cloth is used and not over 212 deg. F. for cotton cloth and the lowest temperature should be above condensation point.

A small motor driven air compressor delivers compressed air for the automatic pneumatic filter cleaning. One man is all that is necessary, it is claimed, to take care of the entire operation.

The complete installation as pictured in the views of the plan, side elevation and section AA will cost, according to manufacturer's estimate, about $125,000. On rated capacity of 100,000 to 125,000 cu. ft. of gas per minute at baghouse temperature this is equivalent to $1 or $1.25 per cu. ft. per minute capacity. This price includes the building, 100 filter compartments with manifolds, fans, motors, screw conveyors, compressors, drives required and erection. Concrete floors and foundations to be put in by purchaser. The cost of the installation is also to be corrected if woolen bags are to be used and side and end walls desired on the building. Coolers and pneumatic conveying system are extra.

The Dust Recovering and Conveying Co., Cleveland, Ohio, the manufacturers of the system, state that a small dust collecting installation in the pack house of the Pittsburgh Plate Glass Co.'s cement plant at Zanesville, Ohio, has given satisfactory results and the same company is also using the system in the agricultural lime department of their Barberton (Ohio) plant. The American Lime and Stone Co. are also said to be using the "Dracco" system on hydrated lime at their Bellefonte (Penn.) plant.

Chain Belt Acquires Stearns Conveyor Company

THE Chain Belt Co., Milwaukee, has taken over the Stearns Conveyor Co., Cleveland, Ohio, engineers and manufacturers of belt conveyors. This makes the sixth of a group of affiliated companies which includes the Chain Belt Co., Sivyer Steel Casting Co., Federal Malleable Co., Interstate Drop Forge, all of Milwaukee, and the Nugent Steel Castings Co., Chicago.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	1.65	1.65	1.40	1.40	1.40
Cobleskill, N. Y.	1.50	1.35	1.25	1.25	1.25	....
Danbury, Conn.	1.50@2.00	2.00	1.75	1.50	1.35	1.25
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@ .75	1.20@1.30	1.15@1.25	1.10@1.15	1.10@1.15	1.05@1.10
Munns, N. Y.	....	1.00	1.50	1.50	1.25	1.25
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	....
Prospect, N. Y.	1.00	1.50	1.40	1.30	1.30	....
Walford, Penn.	.70	....	1.35h	....	....	....
Watertown, N. Y.	1.00	....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Alton, Ill.	1.85	....	1.85	....	....	....
Bloomville, Middlepoint, Dunkirk, Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Carey, Ohio	1.05	1.05	1.05	1.05	1.05	1.05
Chasco, Ill.	1.00@1.30	....	1.00@1.15	....	1.00@1.15	....
Columbia and Krause, Ill.	1.00@1.50	.90@1.10	1.20@1.35	1.00@1.20	.90@1.20	
			Flux 1.50@1.75			
Greencastle, Ind.	1.25	1.25	1.15	1.05	.95	.95
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
Linwood and Buffalo, Ia.	1.10	....	1.30	1.20	1.25	1.25
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
Milltown, Ind.	....	.90@1.10	.90@1.15	.90@1.00	.85@.90	.85@.90
River Rouge, Mich.	1.20	1.20	1.20	1.20	1.20	1.20
St. Vincent de Paul, Que.	.75	1.20@1.45	.90@1.15	.90@ .95	.85	.85
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	1.10
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Ont.	1.55	2.05	2.05	1.90	1.90	1.90
Stone City, Iowa	.75	....	†1.10	1.05	1.00	....
Waukesha, Wis.	.90	.90	.90	.90	.90	....
SOUTHERN:						
Alderson, W. Va.	.50	1.35	1.35	1.25	1.20	1.15
Atlas, Ky.	....	1.00	1.00	1.00	1.00	1.00
Brooksville, Fla.	.75	....	2.65	2.65	2.40	2.00
Carterville, Ga.	....	1.50	1.50	1.35	1.15	1.00
Chico, Tex.	.75	1.35	1.25	1.20	1.10	1.00
El Paso, Tex.	1.00	1.00	1.00	1.00	....	....
Ft. Springs, W. Va.	.50	1.35	1.35	1.20	1.20	....
Graystone, Ala.			Crusher run, 1.00 per ton			
Kendrick and Santos, Fla.			3½ in. and less, 1.00 per ton			
New Braunfels, Tex.	.60	1.25	1.10	.90	.90	.90
Rocky Point, Va.	.50@ .75	1.40@1.60	1.30@1.40	1.15@1.35	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kans.	.25	1.90	1.90	1.90	1.90	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	....	1.25	1.25	1.10	....
Kansas City, Mo.	.75	1.50	1.50	1.50	1.50	1.50
Rock Hill, St. Louis Co., Mo.	1.40	1.45	1.45	1.45	1.45	1.45

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	1.20	1.05	....
Duluth, Minn.	.90	2.25	1.90	1.50	1.35	1.35
Dwight, Calif.	1.00	....	1.00	.90	.90	....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Tex.	2.50	2.25	1.55	1.45	1.20	....
New Haven, New Britain, Meriden and Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	1.05
Northern New Jersey	1.40	2.00	1.80	1.40	1.40	1.40
Oakland and El Cerito, Cal.	1.00	1.00	1.00	.90	.90	....
San Diego, Calif.	....	2.75	2.55	2.35	2.35	....
Springfield, N. J.	1.70	2.10	2.10	1.70	1.60	....
Toronto, Ont.	....	3.58@4.05	3.05@3.80	....	....	....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	....
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Columbia, S. C.	.75	2.00	1.75	1.75	1.60	1.60
Eastern, Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1 20	1.35	1.25	1.20	1.20	1.20
Lithonia, Ga.	.75	2.00b	1.75	1.40	1.40	1.25
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	....
Middlebrook, Mo.	3.00@3.50	....	2.00@2.25	2.00@2.25	....	1.25@3.00
Richmond, Calif.—Quartzite	.75	....	1.00	1.00	1.00	....
Somerset, Pa. (sand rock)	1.85@2.00a	....	1.35@1.50	....	1.00@1.50	....
Toccoa, Ga.	....	1.35	....	1.30	1.30	1.25

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ⅛ in. (c) 1 in., 1.40. (d) 2 in., 1.30 (e) Dust. (f) ¼ in. (h) less 10c discount. (i) 1 in., 1.40.

Agricultural Limestone

(Pulverized)

Alderson, W. Va.—50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh	6.00
Asheville, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Belfast and Rockland, Me. (rail), Lincolnville, Me. (water), analysis $CaCO_3$ 90.04%; $MgCO_3$ 1.5%, 100% thru 14 mesh, bags	4.50
Bulk	3.50
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Blackwater, Mo.—100% thru 4 mesh	1.00
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; pulverized; 50% thru 50 mesh	1.50
Cartersville, Ga.—50% thru 50 mesh	1.50
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Chico, Tex.—50% thru 100 mesh, 2.50; 50% thru 50 mesh	1.75
Colton, Calif.—Analysis 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Ft. Springs, W. Va.—50% thru 4 mesh	1.50
Hillsville, Penn.—Analysis. 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.25; bulk	2.75
Joliet, Ill.—90% thru 100-mesh	4.25
Knoxville, Tenn.—80% thru 200 mesh, 3.00; 80% thru 100 mesh, bags, 3.95; bulk	2.70
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marion, Va.—Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 90% thru 100 mesh	3.90@ 4.50
Middlebury, Vt.—99% thru 50 mesh, 50% thru 200 mesh	2.00
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—50% thru 50 mesh, 2.00; 90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis, $CaCO_3$, 95%; 50% thru 200 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Syracuse, N. Y.—Analysis, 89% $CaCO_3$; $MgCO_3$, 4%; bags, 4.25; bulk	2.75
Toledo, Ohio. 30% through 50 mesh	2.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh	2.30
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50
West Stockbridge, Mass.—Analysis 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—90% thru 4 mesh	1.00
Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh	1.50
Brandon and Middlebury, Vt.—Pulverized, bags, 5.50; bulk	3.50

(Continued on next page)

Agricultural Limestone

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh	1.75
50% thru 4 mesh	1.50
Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh	.80
Columbia, Krause, Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 90% thru 4 mesh	1.35
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh	1.35
Danbury, Conn.—Analysis, 81 to 85% $CaCO_3$	3.75@ 4.75
Dundas, Ont.—Analysis. 53.8% $CaCO_3$; $MgCO_3$, 43.3%; 50% thru 50 mesh	1.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Kansas City, Mo.—50% thru 100 mesh	.75
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk	1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$: 50% thru 50 mesh	1.85@ 2.35
McCook, Ill.—90% thru 4 mesh	.90
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 25 to 45% thru 100 mesh	1.60
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Monroe, Mich. — Analysis, $CaCO_3$, 52.03%; 42.25% $MgCO_3$; 30% thru 100 mesh	2.30
Mountville, Va. — Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh bags	5.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh	1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh	1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stone City, Iowa. — Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes	**1.25**

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk	3.00
Joliet, Ill.—90% thru 200 mesh	4.50
Piqua, Ohio, sacks, 4.50@5.00 bulk	3.00@ 3.50
Rocky Point, Va.—82% thru 200 mesh, 2.50@3.50 bulk, paper bags	3.75@ 4.75
Waukesha, Wis.—90% thru 100 mesh, bulk	4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W. Va	2.00@ 2.25
Buffalo, N. Y	2.00@ 2.50
Cedarville and S. Vineland, N. J.—Damp	1.75
Dry	2.25
Columbus, Ohio	1.00@ 1.50
Estill Springs and Sewanee, Tenn	1.50
Franklin, Penn.	2.00
Gray Summit and Klondike, Mo	2.00
Los Angeles, Calif.—Washed	5.00
Mapleton Depot, Penn	2.00@ 2.25
Massillon, Ohio	3.00
Mendota, Va.	2.25@ 2.50
Mineral Ridge and Ohlton, Ohio	2.50
Oceanside. Calif.	3.00
Ottawa, Ill.	.75@ 1.25
Pittsburgh, Penn.	3.00@ 4.00
Ridgway, Penn.	2.50
Rockwood, Mich.	2.75@ 3.25
Round Top, Md	2.00
San Francisco, Calif.	4.00@ 5.00
Silica, Va.	2.25@ 2.50
St. Louis, Mo	2.00
Sewanee, Tenn.	1.50
Thayers, Penn.	2.50
Utica, Ill.	1.00
Zanesville, Ohio	2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.75
Columbus, Ohio		.30@ 1.50
Dresden, Ohio		1.25
Eau Claire, Wis	4.25	.65@ 1.25
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.	1.40	1.40	2.25		2.25	2.25
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.		1.00*		1.50*	1.75*	
Farmingdale, N. J.		.48	.75	1.20	1.10	
Hartford, Conn.	.65*					
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias Jct., N. Y.		.75	.75		.75	
Montoursville, Penn.	1.00	1.00	1.00	.90	.90	.90
Northern New Jersey	.40@ .50	.40@ .50	1.25	1.25	1.25	
Olean, N. Y.		.75	.75		.75	
Portland, Me.	1.50	1.50	2.75		2.50	
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Penn.		1.85@2.00				
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.85	.85	1.70	1.50	1.30	1.30
York, Penn.	1.10	1.00				
CENTRAL:						
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Appleton and Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Attica, Ind.			All sizes .75@.85			
Aurora, Oregon, Sheridan, Moronts, Yorkville, Ill.	.60	.50	.40	.50	.60	.55
Barton, Wis. (f)		.50		.75	.75	.75
Chicago district, Ill.	.70	.55	.55	.60	.60	.60
Columbus, Ohio	.70	.70	.70	.70		
Des Moines, Ia.		.30	1.40	1.40	1.50	1.50
Eau Claire, Wis.	.65@1.25	.45	.80	.95	.95	
Elgin, Ill.		.20*	.50*	1.50*	1.50*	1.50*
Elkhart Lake, Wis.	.50	.40	.50	.50	.40	.40
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Grand Haven, Mich.		.60@ .70		.70@ .90		.70@ .90
Grand Rapids, Mich.		.50		.80	.80	.70
Hamilton, Ohio		1.00			1.00	
Hersey, Mich.		.50				.70
Humboldt, Iowa	.50	.50	1.50	1.50	1.50	1.50
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Iowa	.50	.50	1.45	1.45	1.35	1.35
Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Mattoon, Ill.	.75	.75	.75	.75	.75	.75
Milwaukee, Wis.		1.01	1.21	1.21	1.21	1.21
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.40@ .60	.40@ .60	1.25	1.25	1.25	1.25
Pittsburgh, Penn.	1.25	1.25	.85	.85	.85	.85
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	.83	1.45	1.55	1.45	1.45	1.45
Terre Haute, Ind.	.75	.60	.75	.75	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.15	1.15
Zanesville, Ohio		.60	.50	.60	.80	
SOUTHERN:						
Charleston, W. Va.		All sand, 1.40. All gravel, 1.50.				
Brewster, Fla.	.60	.60				
Chattahoochie River, Fla.		.70		1.75		
Eustis, Fla.		.60@ .70				
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Knoxville, Tenn.	1.00	1.20	1.20	1.20	1.20	1.00
Lindsay, Texas					.55	
Macon, Ga.	.50	.50				
New Martinsville, W. Va.	1.00	.90@1.00		1.20@1.30		.80@ .90
Roseland, La.	.50	.50	2.25	1.25	1.10	1.10
WESTERN:						
Kansas City, Mo.		.70				
Los Angeles, Calif.	.50	.50	1.10	1.10		1.10
Oregon City, Ore.		1.50*	1.50*	1.50*	1.50*	1.50*
Phoenix, Ariz.	1.25*	1.25*	2.50*	2.00*	1.75*	1.50*
Pueblo, Colo.	.80	.60		1.20		1.30
San Diego, Calif.	.65@ .75	.65@ .75	1.50	1.30	1.10	1.10
Seattle, Wash. (bunkers)	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
Chicago district, Ill.	.35					
Ferrysburg, Mich.						.65@1.00
East Hartford, Ohio	.75*					
Gainesville, Texas						.55
Hersey, Mich.				.50		
Indianapolis, Ind.		Mixed gravel for concrete work, at .65				
Joliet, Plainfield and Hammond, Ill.	.35	1.25				
Macon, Ga.	.40					
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.		Ave. .60 per ton all sizes				
Roseland, La.						.60
Somerset, Penn.		1.85@2.00		1.50@1.75		
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.10	1.00				

(a) ⅝ in. down. (b) River run. (c) 2½ in. and less.
*Cubic yd. †Include freight and bunkerage charges and truck haul. ‡Delivered on job.
(d) Less 10c per ton if paid E.O.M. 10 days. (e) pit run. (f) plus 15c winter loading charge.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.	....	....	....	.30@ .35	....	....	....
Albany, N. Y.	2.00	2.00	2.25	....	....	3.50	....
Arenzville, Ill.	1.50@1.75	....	....	1.00	....	....	....
Beach City, Iowa	2.00	2.00	....	1.75	2.00	....	....
Buffalo, N. Y.	1.50	1.50	....	2.00@2.50	....	....	....
Columbus, Ohio	1.25@2.00	1.25@1.75	2.00@2.50	.30@1.50	2.00@2.50	2.75@3.50	1.50@3.00
Dresden, Ohio	1.50@1.75	1.50	1.75	1.25	....	....	....
Eau Claire, Wis.	....	....	....	....	....	3.00	....
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Elnora, N. Y.	....	....	1.75	....	....	....	....
Estill Springs and Sewanee, Tenn.	1.25	....	....	1.25	....	1.35@1.50	....
Franklin, Penn.	1.75	1.75	2.00	1.75	....	....	....
Klondike, Mo.	1.75@2.00	....	1.75@2.00	1.75@2.00	1.75@2.00	....	....
Mapleton Depot, Pa.	2.00@2.25	2.00	2.25	2.00	2.00	2.00@2.25	....
Massillon, Ohio	2.50	....	....	2.50	2.50	....	....
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.	....	....	....	.30	.30	....	....
Millville, N. J.	....	....	....	1.75b	....	3.50	....
Montoursville, Penn.	....	....	....	1.25@1.50	....	....	....
New Lexington, O.	2.00	1.50	....	....	....	....	....
Ohlton, Ohio	1.80b	1.80b	....	2.00b	1.80b	1.75b	....
Ottawa, Ill.	....	....	2.50	1.25	.75	3.50	3.00
Ridgeway, Penn.	1.50	1.50	....	....	....	....	....
Round Top, Md.	1.25	....	....	1.60	....	2.25	....
San Francisco, Calif.	3.50	4.75	3.50	3.50@5.00	3.50@4.50	3.50@5.00	....
Silica, Va.	....	....	....	10.00@16.00	....	....	....
Tamalco, Ill.	....	1.40@1.60	....	....	....	....	....
Thayers, Penn.	1.25	1.25	....	2.00	....	....	....
Utica, Ill.§	.40@1.00	.40@1.00	1.00	.40@1.00	.60@2.00	3.00@3.50	1.00@3.50
Utica, Ill.	.65	.75	....	.75	.75	....	....
Utica, Penn.	1.75	1.75	....	2.00	....	....	....
Zanesville, Ohio	2.00	1.50	2.00	2.00	2.00	....	....

*Green. †Crude silica, crushed and screened, not washed or dried. ‡Plus 75c per ton for winter loading. ¶Crude. §Crude and dry. (a) Delivered. (b) Damp.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium and Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Pa.	2.50	1.00	....	1.25	....	....	....
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.45*	1.80*	1.45*	1.45*	1.45*	....
Jackson, Ohio	....	1.05*	....	1.30*	1.05*	1.30*	....
Toledo, Ohio	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.	....	1.55*	....	1.55*	1.55*	1.55*	....
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	....

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.	....	....	12.00	....	....	....	....	2.15e
Buffalo, N. Y.	....	12.00	12.00	12.00	....	....	10.00	1.95d
Chazy, N. Y.	12.50	10.50	8.00	12.00	11.50	16.50	10.00	2.50$_2$
Lime Ridge, Penn.	....	....	....	....	5.00a	....	....	....
West Stockbridge, Mass.	12.00	10.00	5.60	....	....	....	....	2.00t
Williamsport, Penn.	....	....	10.00	....	....	....	6.00	....
York, Penn.	....	9.50	9.50	10.50	8.50	10.50	8.50	1.65i
CENTRAL:								
Afton, Mich.	....	....	....	....	....	....	8.50	1.35
Carey, Ohio	8.50	8.00	....	....	9.00	....	8.50	1.50
Cold Springs, Ohio	12.50	8.50	8.50	....	9.00	....	8.00	....
Delaware, Ohio	....	8.50	8.50	9.00	....	....	7.50	1.50c
Frederick, Md.	....	10.00	10.00	10.00	8.50	10.00	7.00	....
Gibsonburg, Ohio	12.50	8.50	8.50	....	9.00	11.00	8.00	....
Huntington, Ind.	12.50	8.50	8.50	....	9.00	....	8.00	....
Luckey, Ohio	12.50	....	....	....	....	....	....	....
Marblehead, Ohio	....	8.50	8.50	....	9.00	....	8.00	1.50w
Marion, Ohio	....	8.50	.850	....	....	....	8.00	1.70d
Milltown, Ind.	....	9.00@10.00	....	10.00p	....	....	8.50q	1.40r
Sheboygan, Wis.	11.50	....	....	....	....	....	9.50	.95
Tiffin, Ohio	....	....	....	....	9.00	....	....	....
White Rock, Ohio	12.50	....	....	....	9.00	11.00	8.00	....
Wisconsin points (f)	....	11.50	....	....	....	....	9.50	....
Woodville, Ohio	12.50	8.50	8.50	13.50	9.00	10.50	9.00	1.50
SOUTHERN:								
Allgood, Ala.	12.50	10.00	....	....	8.50	....	8.50	1.50
El Paso, Tex.	22.50	....	....	....	....	....	8.00	....
Graystone, Ala.	12.50	10.00	....	12.50	....	....	8.50	1.50
Keystone, Ala.	....	10.00	10.00	10.00	8.50	....	....	1.50
Knoxville, Tenn.	20.50	10.00	9.00	10.00	8.50	1.35	8.00	1.50
Longview, Ala.	12.50	10.00	9.00	10.00	....	....	8.50	1.50
New Braunfels, Tex.	18.00	12.00	10.00	12.00	10.00	....	9.50	....
Ocala, Fla.	14.00	13.00	12.00	13.00	....	....	12.00	1.70
Saginaw, Ala.	12.50	10.00	9.00	10.00	....	....	8.50	1.50
WESTERN:								
Kirtland, N. M.	....	....	....	....	....	....	15.00	....
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Dittlinger, Tex.	....	12.00@13.00	....	....	....	....	9.50p	1.50,
San Francisco, Calif.	21.00	19.00	16.50	....	....	....	14.00	2.00
Tehachapi, Calif.	....	....	8.00	....	....	....	13.00z	2.20x
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00	....	18.60	2.30

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) steel; (e) per 180-lb. barrel; (f) dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days; (i) 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65; (p) to 11.00; (q) to 8.75; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) to 3.00; (u) two 90-lb. bags; (v) oil burnt; wood burnt 2.25@2.50; (x) wood, steel 2.30; (z) to 15.00; (*) quoted f.o.b. New York; (‡) paper bags; (w) to 1.50 in two 90-lb. bags, wood bbl. 1.60; (¶) to 10.00; (1) 80-lb. paper bags; (2) to 3.00; (3) to 9.00; (4) to 1.60. (5) to 16.00; (6) wood bbl., steel, 1.80.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Gray Summit and Klondike, Mo.	2.00	....
Mapleton Depot, Penn.	2.00	2.00@ 2.25
Massillon, Ohio	....	2.25
Michigan City, Ind. (Engine sand)	....	.15@ .25
Mineral Ridge, Ohio	*1.75@ 2.00	*1.75
Montoursville, Penn.	....	1.25
Ohlton, Ohio	1.80	1.80
Ottawa, Ill.	1.25	1.25
Red Wing, Minn.	....	1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50@ 4.50	3.50@ 4.50
Thayers, Penn.	....	2.25
Utica, Ill.	1.00@ 3.50	.90
Warwick, Ohio	....	2.25
Zanesville, Ohio	....	2.50

*Wet.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point,

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons	.08
per gross	1.00@ 1.50
Chatsworth, Ga.:	
Crude Talc	5.00
Ground (150-200 mesh), bulk	10.00
Pencils and steel worker's crayons, per gross	1.50@ 2.00
Chester, Vt.:	
Ground talc (150-200 mesh), bulk	9.00@10.00
Including bags	10.00@11.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc	5.00
Ground talc (150-200) bags	10.00@12.00
Pencils and steel workers' crayons, per gross	1.00@ 1.50
Emeryville, N. Y.:	
(Double air floated) including bags; 325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 300-350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.00
Ground talc (150-200 mesh), bulk	7.75@14.00
Joliet, Ill.:	
Roofing talc, bags	12.00
Ground talc (200 mesh), bags	30.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (125-200 mesh), bags	10.00@15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 5.00
Mt. Pleasant, Tenn.—B.P.L. 75%	5.50@ 6.00
Tennessee—F.O.B. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	8.00@ 9.00

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65%	7.00
Gordonsburg, Tenn.—B.P.L. 68-72%	4.00@ 5.00
Mt. Pleasant, Tenn.—B.P.L. 65%	8.00@10.00
Twomey, Tenn.—B.P.L. 65%	8.00@ 9.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton, 68/66% B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75

Mica

Prices given are net, F.O.B. plant or nearest shipping point.

Franklin, N. C.—Mine run, per lb.	.05@.10
Mine scrap, per ton	20.00
Clean shop scrap, per ton	22.00
Punch mica, per lb.	.05@.10
Pringle, S. D.—Mine run, per ton	125.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H.—per ton,	
Mine run	360.00
Clean shop scrap	25.00
Mine scrap	22.00
20 mesh	35.00
60 mesh	45.00
100 mesh	47.50
200 mesh	60.00
Punch, mica, per lb.	.12

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars		10.50
Brandon, Vt.—English pink, English cream and coral pink	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—Pink	6.00	5.00
Mixed pink and bronze	4.50@ 6.00	4.50@ 6.00
All colors, mixed sizes	3.50	3.50
Buckingham, Que.—Buff stucco dash		12.00@14.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries		17.50
Crown Point, N. Y.—Mica Spar		8.00@10.00
Dayton, Ohio		6.00@24.00
Easton, Penn., and Phillipsburg, N. J.	12.00@16.00	12.00@16.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash		6.00@18.00
Middlebrook, Mo.—Red		25.00@30.00
Middlebury, Vt.—Middlebury white	‡9.00	‡9.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		5.50
Milwaukee, Wis.		14.00@34.00
Newark, N. J.—Roofing granules		7.50
New York, N. Y.—Red and yellow Verona		32.00
Red Granite, Wis.		7.50
Stockton, Calif. — "Natrock" roofing grits		12.00@15.00
Tuckahoe, N. Y.—Tuckahoe white	12.00	12.00
Wauwatosa, Wis.		20.00@32.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00

†C.L. L.C.L. 17.00.
*C.L. including bags; L.C.L. 14.50
‡C.L. including bags, L.C.L. 10.00.

Potash Feldspar

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk	19.00
Buckingham, Que.—Color, white; analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white; bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% through 60 mesh, bags	16.00
96% thru 150 mesh, bags	23.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk	15.50
Glen Tay Station, Ont., color, red or pink; analysis: K_2O, 12.81%, crude (bulk)	7.00
Keystone, S. D.—Prime white, bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 13.78%; Na_2O, 3.68%; SiO_2, 62.97%; Fe_2O_3, .23%; Al_2O_3, 19.20%; crude	10.00@11.50
Pulverized, 96% thru 200 mesh, bags, 22.00@23.50; bulk	20.00
Murphysboro, Ill.—Color, prime white; analysis, K_2O, 12.60%; Na_2O, 2.35%; SiO_2, 63%; Fe_2O_3, .06%; Al_2O_3, 18.20%; 98% thru 200 mesh; bags, 21.00; bulk	20.00
Penland, N. C.—Color, white; crude, bulk	8.00
Ground, bulk	16.50
Spruce Point, N. C., and Bristol, Tenn.—Color, white; 90% thru 200 mesh, bulk	12.50@20.00
Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 68% SiO_2; 99% thru 200 mesh; bulk	18.00
99% thru 140 mesh, bulk	16.00
Topsham, Me.—98% thru 140 mesh, bulk	19.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00

Blended Feldspar
(Pulverized)

Tenn. Mills—Bulk	16.00@20.00

Chicken Grits

Afton Mich. (limestone) per ton	10.00
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt., per ton	10.00
Cartersville, Ga.—(Limestone), per bag	2.00
Centerville, Iowa (gypsum) per ton	18.00
Chico, Texas (limestone), 100 lb. bags, per ton	8.00@ 9.00
Danbury, Conn. (limestone)	7.00@ 9.00
Easton, Penn.—Per ton, bulk	3.00
Joliet, Ill.—(Limestone), bags, per ton	4.50
Knoxville, Tenn.—per bag	1.00
Los Angeles Harbor (limestone), 100-lb. sack, 1.00; sacks, per ton, 8.50@9.50†; bulk, per ton	6.00@7.00†
Gypsum, Ohio.—(Gypsum) per ton	10.00
Limestone, Wash. (limestone) per ton	12.50
Rocky Point, Va. (limestone) 100 lb. bags, 50c; sacks, per ton, 6.00 bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	12.00
Warren, N. H.—(Mica) per ton	7.70@7.90‡
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone) bulk	7.50@9.60*

*L.C.L.
†Less than 5-ton lots.
‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass.	*17.00
Brighton, N. Y.	*19.75
Dayton, Ohio	12.00@13.50
Detroit, Mich.	17.50
Farmington, Conn.	13.00
Flint, Mich.	¶12.50@16.00
Grand Rapids, Mich.	12.00
Hartford, Conn.	*19.00
Jackson, Mich.	13.00
Lake Helen, Fla.	10.00@15.00
Lancaster, N. Y.	12.50
Madison, Wis.	a12.50
Michigan City, Ind.	11.00
Milwaukee, Wis.	*13.00
Minneapolis and St. Paul, Minn.	11.25
Minnesota Transfer	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	13.50@17.00
Portage, Wis.	15.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	*19.75
Saginaw, Mich.	13.00
San Antonio, Texas	16.00
Sebewaing, Mich.	12.00
Syracuse, N. Y.	16.00@20.00*
Toronto, Canada	15.60†
Toronto, Canada	13.10
Wilkinson, Fla.	10.00@12.00

*Delivered on job. †Sales tax included.
‡Less 5%. ¶Dealers' price. (a) Less .50 E.O.M. 10 days.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	.86¾	3.47
Atlanta, Ga.		2.35
Baltimore, Md.		2.15
Birmingham, Ala.		2.30
Boston, Mass.		2.43
Buffalo, N. Y.		2.28
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa		2.34‡
Charleston, S. C.		2.35
Cheyenne, Wyo.	.82¾	3.31
Cincinnati, Ohio	56¾	2.37‡
Cleveland, Ohio		2.29‡
Chicago, Ill.		2.10‡
Columbus, Ohio		2.34
Dallas, Texas		2.10
Davenport, Iowa		2.29‡
Dayton, Ohio		2.38
Denver, Colo.	.66¼	2.65
Detroit, Mich.	.48¾	1.95
Duluth, Minn.		2.09‡
Houston, Texas		2.60
Indianapolis, Ind.		2.29‡
Jackson, Miss.		2.60
Jacksonville, Fla.		2.20
Jersey City, N. J.		2.13
Kansas City, Mo.		1.92
Los Angeles, Calif.	.59½	2.44†
Louisville, Ky.	.54¼	
Memphis, Tenn.		2.60
Milwaukee, Wis.		2.25‡
Minneapolis, Minn.		2.32‡
Montreal, Que.		1.36
New Orleans, La.		2.20
New York, N. Y.		2.05
Norfolk, Va.		2.17
Oklahoma City, Okla.		2.46
Omaha, Neb.		2.36
Peoria, Ill.		2.27‡
Philadelphia, Penn.		2.21
Phoenix, Ariz.	.81½	3.26
Pittsburgh, Penn.		2.09‡
Portland, Colo.		2.80
Portland, Ore.		2.70
Reno, Nevada		2.91
Richmond, Va.		2.44
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.		2.21
Savannah, Ga.		2.50
St. Louis, Mo.	.55	2.20
St. Paul, Minn.		2.32‡
Seattle, Wash.	10c discount	2.50
Tampa, Fla.		2.25
Toledo, Ohio		2.20‡
Topeka, Kans.		2.41
Tulsa, Okla.		2.33
Wheeling, W. Va.		2.17
Winston-Salem, N. C.		2.78

NOTE—Add 40c per bbl. for bags.
†Delivered on job in any quantity, sacks extra.
‡Ten cents discount for cash, 15 days.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.		1.85
Chattanooga, Tenn.		2.45*
Concrete, Wash.		2.35
Davenport, Calif.		2.05
Detroit, Mich.		2.15
Hannibal, Mo.		1.85
Hudson, N. Y.		1.95
Leeds, Ala.		1.95
Mildred, Kans.		2.35
Nazareth, Penn.		1.95
Northampton, Penn.		1.85
Richard City, Tenn.		2.05
Steelton, Minn.		1.90
Toledo, Ohio		2.20
Universal, Penn.		1.85

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x 36". Wt. 1500 lb. Per M Sq. Ft.	⅜x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev. and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u	....	....	....	....	11.70u	....	....	....
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50	....	....	13.50	....	....	....
Des Moines, Ia.	3.00	8.00	9.00	10.00	10.00	10.50	13.50	12.00	24.00	22.00	18.00	21.00	30.00
Detroit, Mich.	....	....	....	....	....	....	....	m9.00@11.00o	....	....	....	....	....
Delawanna, N. J.	——	——	——	——	——	8.00	....	8.25@9.40	....	....	.14½s	.15½s	40.00@41.00
Douglas, Ariz.	....	....	7.00	....	....	15.50d	18.50	....	30.00	15.50	....	....	....
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50	....	24.55	20.00	....	....	....
Gypsum, Ohio‡	3.00	4.00	6.00	7.00	9.00	9.00	19.00	7.00	25.00	20.00	....	15.00	30.00
Los Angeles, Calif.	....	....	....	8.50	....	....	....	....	....	....	....	....	....
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00	....	20.00	30.00
Portland, Colo.	....	....	....	10.00	....	....	....	....	....	....	....	....	....
San Francisco, Cal.	....	....	14.00	14.40	15.40	....	15.40	....	....	....	....	....	....
Seattle, Wash.	6.50	11.00	11.00	15.00@16.00	....	....	....	....	....	....	....	....	....
Sigurd, Utah	....	....	....	....	....	....	....	....	21.50	....	....	....	....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	....	....	....	....	20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross; (d) hair fibre; (g) delivered; (h) delivered in six states; (i) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board; (t) to 16.50; (u) includes sacks; (v) F.O B. N. Y. C. and dealers yard in mill locality.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City of shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00	......	......
Cement City, Mich.		5x8x12—55.00¶	
Columbus, Ohio	.16@.18a	......	......
Detroit, Mich.	.16	......	.18
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	.15	......	......
Graettinger, Iowa	.18@.20	......	......
Indianapolis, Ind.	.13@.15†	......	......
Los Angeles, Calif.¶	5¾x3½x12—55.00	7¾x3½x12—65.00	
Oak Park, Ill.	.18@.21a	......	......
Olivia and Mankato, Minn.	9.50b	......	......
Somerset, Penn.	.18@.22	......	......
Tiskilwa, Ill.	.16@.18†	......	......
Yakima, Wash.	20.00*	......	......

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in carload lots, f.o.b. nearest shipping point unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00

Chicago, Ill.—per sq. 20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate, Red and Orange	Green Blue
French and Spanish†	$11.50	$13.50
Ridges (each)	.25	.35
Hips	.25	.35
Hip starters	.50	.60
Hip terminals, 2-way	1.25	1.50
Hip terminals, 4-way	4.00	5.00
Mansard terminals	2.50	3.00
Gable finials	1.25	1.50
Gable starters	.25	.35
Gable finishers	.25	.35
*End bands	.25	.35
*Eave closers	.06	.08
*Ridge closers	.05	.06

*Used only with Spanish tile.
†Price per square.

Houston, Texas.—Roofing Tile, per sq. 25.00

Indianapolis, Ind.—9x15-in. Per sq.

Gray	10.00
Red	11.00
Green	13.00

Waco, Texas: Per sq.

4x4	.60

Cement Building Tile

Cement City, Mich	Per 1000
5x8x12	55.00
Detroit, Mich.	Per 100
5x4x12	4.50
5x8x12	8.00
Longview, Wash.	Per 1000
4x6x12	52.00
4x8x12	64.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Grand Rapids, Mich.:	Per 1000
5x8x12	70.00
Houston, Texas:	
5x8x12 (Lightweight)	80.00
Pasadena, Calif. (Stone-Tile)	Per 100
3½x4x12	3.00
3½x6x12	4.50
3½x8x12	6.00
Tiskilwa, Ill.—8x8, per 100	15.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile)	Per 1000
3½x6x12	50.00
3½x8x12	60.00
Prairie du Chien, Wis... 14.00	22.50@27.00
Yakima, Wash.—Building tile:	
5x8x12	.10

Cement Drain Tile

Graettinger, Iowa—5 to 36 in., per ton	8.00
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	9.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	30.00@35.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Ensley, Ala. ("Slag-tex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	18.00	25.00@75.00
Milwaukee, Wis.	15.00	25.00@75.00
Mt. Pleasant, N. Y.		14.00@23.00
Omaha, Neb.	18.00	30.00@40.00
Pasadena, Calif.	11.00	......
Philadelphia, Penn.	15.00	20.00
Portland, Ore.	17.00	25.00@75.00
Prairie du Chien, Wis.	14.00	23.00@27.00
Rapid City, S. D.	18.00	25.00@80.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Wauwatosa, Wis.	14.00	21.00@42.00
Westmoreland Wharves, Penn.	15.00	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	......

†Gray. ‡Red.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								15.00 per ton									
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17½	......	.40	.50	.60	.70	......	......	......	......	......	......	......
G'd Rapids, Mich. (b)	......	......	......	.60	.72	1.00	1.28	......	......	1.92	2.32	3.00	4.00	5.00	6.00	......	......
Houston, Texas	......	.19	.28	.43	.55½	.90	1.30	......	†1.70	2.20	......	......	......	......	......	......	......
Indianapolis, Ind. (a)	......	......	......	.80	.90	1.10	1.30	......	......	1.70	......	2.70	......	......	......	......	......
Longview, Wash.							Sewer pipe 40% off list, culvert—list										
Mankato, Minn. (b)	......	......	......	......	......	......	......	......	......	1.50	1.75	2.50	3.25	4.25	......	......	......
Newark, N. J.						6 in. to 24 in., $18.00 per ton											
Norfolk, Neb.	......	......	......	.90	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	......	6.14	......	7.78
Olivia, Mankato, Minn.							12.00 per ton										
Paullina, Iowa‡	......	......	......	......	......	......	......	2.25	......	2.11	......	2.75	3.58	......	6.14	......	7.78
Somerset, Penn.	......	......	......	......	1.08	1.25	1.65	......	......	2.50	......	3.65	4.85	7.50	8.50	......	......
Tacoma, Wash.	.15	.18	.22	.30	.40	.60	.75	......	......	......	......	......	......	......	......	......	......
Tiskilwa, Ill. (rein.) (a)	......	......	......	.65	.75	.85	1.10	1.60	......	1.90	......	2.25	3.40	......	5.50	......	......
Wahoo, Neb. (b)	......	......	......	......	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	4.62	6.14	6.96	7.78
Waukesha, Wis.								12 in. to 60 in. 18.00 per ton									
Yakima, Wash.									$10.00 per ton								

*30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced.
†21-in. diam. ‡Price per 2 ft. length. (d) 5 in. diam. [1]@1.08 [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00. [7]@7.50.

Mixed Concrete Plant Planned for Kansas City

A CENTRAL concrete mixing plant, the first to be installed at Kansas City, Mo., will be built and operated by the W. A. Ross Construction Co. The plant will be located on a 3-acre site served by the Terminal and the Frisco railroad. Ready-mixed concrete for all classes of construction work will be supplied to builders and contractors.

The Ross company, it is said, will erect several other buildings on the property in addition to the mixing plant. These will consist in part of a garage, machine shop and storehouse for various equipment.

Colored Cement Panels Imitate Stained Glass Windows

A PROCESS has been perfected by Thomas Beattie, an Edinburgh sculptor, for the production of inlaid colored portland cement panels conveying a resemblance, in their general effect, to stained glass windows. A set of panels, for an important public building now being erected in Edinburgh to the plans of a Glasgow architect, has just been carried out in this new method of decoration.

Leading architects have examined the process, the possibilities of which are considered to be great. The various colors used are mixed with the cement before the inlaying process is begun. The "leads" in stained glass work are represented by the white borders outlining the cavities in the original plaque.—*Contract Journal (London).*

"The Portland Cement Industry"

A REPRINT of an article on the portland cement industry by Richard K. Meade has just been issued by the magazine *Industrial and Engineering Chemistry,* in which it was originally published. It is an interesting account of the industry, mainly historical, but also explaining the development of the present manufacturing methods. America's contribution to cement technology is summarized as: Invention of the dry process, successful application of the rotary kiln, use of pulverized fuel, development of large crushing units, the utilization of waste heat for power generation, and the automatic sacking of cement.

New Vice-President of Texas Portland Cement Company

E. S. MORGAN is once more with the Texas Portland Cement Co.—but in a new and increased position of importance. The directors of the International Cement Corp., of which the Texas company is a subsidiary, have recognized Mr. Morgan's efficient work at the Uruguay and Argentine subsidiaries by electing him vice president and manager of the Texas Portland Cement Co., with plants at Houston and Dallas.

E. S. Morgan

Mr. Morgan began his career in the cement industry with the Texas Portland in 1915. He was then traffic manager and remained with them until 1919, when he resigned to enter another line of business. In 1920 he joined the forces of the International Cement Corp. and went to Montevideo, Uruguay, as manager of the company's cement plant at that place. This position he occupied until 1922, when he was elected vice president and manager of the International company's Argentine plant and also remained in charge of the Uruguayan plant as vice president, merely transferring his headquarters to Buenos Aires. In September, 1926, he was transferred back to the United States and elected to his present position.

Atlas Portland Changes Central Headquarters

THE Atlas Portland Cement Co., operating several plants in various parts of the country, together with two subsidiaries, is contemplating moving its central states sales headquarters from Chicago to St. Louis, according to a report appearing recently in the *Globe-Democrat,* St. Louis, Mo. The announcement, it is said, was made by F. P. Allen, manager of the St. Louis office.

The personnel and records from the main office at Chicago will be moved to St. Louis by the middle of December, it is expected. Chicago will become a branch office. Headquarters will be in the Ambassador Building. Mr. Allen stated that the company was prompted to set up its chief office here because of the more central location of St. Louis, which is readily accessible to all its plants, notably to those at Hannibal, Independence, Kans., and the mill near Birmingham, Ala.

Alabama Portland Completes Plans for Wet Process

THE engineering work and details have been recently completed for changes in equipment by which the Alabama Portland Cement Corp. plant at North Birmingham, Ala., will be converted to a modern wet process mill. Specifications call for an expenditure of about $500,000.

Orders for the kiln extensions necessary and the cooler equipment have been placed with Reeves Bros. Co., Birmingham, and an early delivery anticipated. No increase in capacity, it is stated, will result from the change from the dry to the wet process, but increased efficiency in operation with improvements in working conditions are expected to be obtained.

The Alabama company is a subsidiary of the International Cement Corp., New York. The present capacity is about 5500 bbl. per day obtained from four kilns, 10x150 ft., coal fired.

Lawrence Portland Takes Over New England Cement and Lime Company

THE Lawrence Portland Cement Co. of Siegfried, Penn., has exercised the option which it held on the New England Portland Cement and Lime Co. of Rockland and Thomaston, Maine, and has taken over the property. This is said to represent an investment of more than $1,500,000 and includes very large deposits of cement rock and lime rock.

The announcement was made before the firing of the new lime kiln which the stockholders of the New England company celebrated with an old fashioned barbecue on Saturday, November 20. The affair was one of public importance, as many notables from New England and other parts of the country were present.

It is currently reported in the press that a new cement plant, to cost between $2,000,000 and $3,000,000, is to be built at once.

Allen E. Beals, commenting on the purchase in the *Dow Service Daily Building Reports,* speaks of this as one of the moves of the larger producers of building materials to protect themselves so far as possible against foreign competition. This competition is already established in cement and the lime industry will probably have it to meet before long.

Allan Heads Concrete Products Work of Portland Cement Association

ANNOUNCEMENT has been made that W. D. M. Allan has been appointed manager of the Cement Products Bureau of the Portland Cement Association, effective November 1, to succeed A. J. R. Curtis, who became assistant to the general manager of the association on the same date. Mr. Allan who is widely known in the building and cement products field, has been engaged in the promotion of concrete products for the past seven years. Formerly he was a member of the Cement Products Bureau staff, but more recently he served as office manager of the Illinois district office of the association.

The Cement Products Bureau handles one of the most important divisions of association activities, which include concrete masonry houses and structures of all kinds, stucco, lighting standards, cast stone, roofing tile, as well as concrete around the home and farm uses.

Universal Portland at Duluth Dedicates Safety Monument

DEDICATION of the safety monument awarded by the Portland Cement Association to the Universal Portland Cement Co.'s plant in Duluth, Minn., for establishing the best safety record of any cement plant in the United States during 1925, took place recently, according to the Duluth (Minn.) *Herald.* Ceremonies were attended by leading executives of the association, including Blaine S. Smith of Chicago, president; H. G. Jacobson, formerly manager of the bureau of accident and prevention, Portland Cement Association; John Ahnfelt, operating manager. In addition, about 100 prominent Duluth business and professional men were present, while several hundred employes at the plant also witnessed the ceremonies. Roy S. Huey, superintendent of the Duluth branch, presided.

During 1925 the Duluth plant made a perfect score with no lost-time accidents throughout the year, the best record in this country. There were 460 employes enrolled during the year. The plant of the Canada Cement Co. at Port Colborne, Ont., also made a perfect record and was recently awarded a similar safety monument. L. M. McDonald, superintendent of this plant, participated in the ceremonies at Duluth.

The monument is of concrete, about 8 ft. high, and weighs about 75 tons, with a group of figures in bas-relief, and the inscription, "Safety follows wisdom." It was erected by the Benedict Stone Co. of Chicago.

The Universal Portland Cement Co. operates three plants—Buffington, Ind., Universal, Penn., and Duluth. B. F. Affleck is president; A. C. Wilby, assistant to president, and E. B. Harkness, secretary. Headquarters are at 210 S. La Salle St., Chicago.

New York State Crushed Stone Association Meeting at Buffalo

THE regular monthly meeting of the New York State Crushed Stone Association was held at the Statler hotel in Buffalo, N. Y., on Friday, November 11. Much to its regret, ROCK PRODUCTS was not represented on this occasion by one of its editorial staff. The feature of the occasion was the showing of movies made by James Savage at former meetings of the year and a special reel of the directors' meeting at Atlantic City. The pictures are reported to have been judiciously edited.

Matters of vital importance to the industry were discussed at this meeting, as will be seen from the following account furnished ROCK PRODUCTS by George F. Schaefer, the secretary and treasurer of the association:

Compensation Insurance Rates to Be Raised

"After approving the minutes of the October meeting at Le Roy and presenting various communications of a minor nature, the important question of forthcoming increases in workman's compensation insurance was taken up. As we understand the matter, on January 1 there will be an increase of approximately 33% per $100 of payroll, the present fee being $12 plus and the advanced fee to be $16 plus. This was seriously discussed for about an hour, culminating in the appointment of a committee of four members, Messrs. Savage, Sporborg, Heimlich and Odenbach, to make investigations in relation to the division of classification between commercial producers and contractor producers and report at the December meeting in Albany. It is of interest to note that Mr. Odenbach has inaugurated a plan of self-insurance in his Rochester quarry since August 17 and stated that it was considerably cheaper than through one of the regular companies.

Added Fuel Cost Expected

"A letter from John Rice was then presented to the meeting disclosing the fact that in addition to the proposed increases in compensation insurance we could also look for an increase in fuel destination costs for 1927 ranging possibly from 60 to 70%. This with the consequent further increase to be reflected in power costs, warranted the belief that the cost of producing stone next spring would be increased 5 to 6 cents per ton. A number of other members present concurred in Mr. Rice's belief and needless to say the reaction was such as to give the majority serious concern and provoke considerable discussion.

"Then came the luncheon, a very acceptable contribution on the part of our Buffalo hosts, followed by the aforementioned movies, and again followed by more business.

"The question of the proposed new standardization of sizes proposed by Engineering Director Goldbeck was again opened for discussion and this also resulted in much talk ending in the request that the old committee of Messrs. Savage and Sporborg negotiate with Mr. Goldbeck in relation to his suggestions and take such action in behalf of the association as their good judgment may dictate.

"Lastly, the question of liquidating the unpaid balance of the $6000 contribution to the National Association, amounting to about $600. A motion was passed to pay up this balance before January 1. It was decided to communicate with those who had not as yet contributed asking for their donation and if the balance were not forthcoming through such channels to prorate the remainder among the contributing companies of last spring on the basis of their donations at that time.

"The annual meeting was scheduled for Albany. The exact date will be decided upon later. This is hoped to be a large meeting when the officers for 1927 will be elected and arrangements made to attend the annual National Association convention at Detroit.

"Then a motion to thank the Buffalo hosts for their hospitality for the day, after which adjournment at 6 p. m."

Wisconsin Mineral Aggregate Association Meets Dec. 16

THE annual meeting of the Wisconsin Mineral Aggregate Association is to be held in Milwaukee, December 16; the exact place in which the meeting is to be held will be announced later.

There will be three sessions. The morning session will be open to members only. Officers will be elected at this session and association business transacted.

The afternoon session will be open to all producers and those of allied interests. The program and the discussion are such that they will interest all producers of sand, gravel and crushed stone.

In the evening there will be the usual dinner and entertainment.

C. F. Daggett is executive secretary of the association, to whom communications may be addressed. The office of the association is room 6098, Plankington building, Milwaukee, Wis.

Lease North Carolina Quarry

THE Guilford County, North Carolina, rock quarry, located north of Greensboro, N. C., has been leased to R. G. Lassiter & Co., paving contractors, for another period of three years at $10,000 per year, the lease carrying a clause giving the paving company the right for a renewal for another term of three years at the conclusion of the original three at the yearly price.

When the lease has expired the county will have received $60,000 from the Lassiter company from the quarry located on property that the present board of commissioners purchased and put in operation. Certain equipment has been installed, the complete cost being less than the amount that will be derived from leasing the property.

Rock Products Available at Many Public Libraries

THE following libraries located in various cities in the United States and Canada have been listed by the Research Information Service of the National Research Council as regular receivers of ROCK PRODUCTS. Practically all of the libraries have also indicated their willingness to lend any copies on hand to research workers or libraries interested. The name and location of these libraries are:

U. S. Department of Agriculture, Washington, D. C.
University of Arizona, Tucson, Ariz.
Bridgeport Public Library, Bridgeport, Conn.
University of Cincinnati, Cincinnati, Ohio.
Cleveland Public Library, Cleveland, Ohio.
University of Colorado, Boulder, Colo.
Columbia University, New York City.
Denver Public Library, Denver, Colo.
Detroit Public Library, Detroit, Mich.
El Paso Public Library, El Paso, Tex.
Engineering Societies Library, 29 West Thirty-ninth St., New York City.
Ford, Bacon and Davis, Inc., 115 Broadway, New York City.
U. S. Geological Survey, Washington, D. C.
University of Illinois, Urbana, Ill.
Indianapolis Public Library, Indianapolis, Ind.
State University of Iowa, Iowa City, Iowa.
Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa.
John Crerar Library, Chicago, Ill.
Johns Hopkins University, Baltimore, Md.
Lehigh University, Bethlehem, Pa.
Massachusetts Institute of Technology, Cambridge, Mass.
Mechanics-Mercantile Library, San Francisco, Calif.
University of Michigan, Ann Arbor, Mich.
Minneapolis Public Library, Minneapolis, Minn.
University of Minnesota, Minneapolis, Minn.
University of Missouri, Columbia, Mo.
New York Public Library, New York City.
New York State Library, Albany, N. Y.
University of North Dakota, Grand Forks, N. D.
Ohio State University, Columbus, Ohio.
University of Oregon, Eugene, Ore.
Free Library of Philadelphia, Philadelphia, Pa.
Carnegie Library of Pittsburgh, Pittsburgh, Pa.
Library Association of Portland, Portland, Ore.
Princeton University, Princeton, N. J.
St. Louis Public Library, St. Louis, Mo.
Seattle Public Library, Seattle, Wash.
Bureau of Standards, Washington, D. C.
University of Wisconsin, Madison, Wis.
Mines Branch, Dept. of Mines, Ottawa, Ont., Canada.
Western Society of Engineers, Chicago, Ill.

Empire State Sand and Gravel Producers Meet

THE regular fall meeting of the Empire State Sand and Gravel Producers Association was held at Hotel Syracuse in Syracuse, N. Y., on November 10. The executive committee arrived the evening before and held a session at that time. The meeting proper began Wednesday morning and lasted throughout the day, including the lunch hour.

Members reported that a sand and gravel shortage appeared to be impending, to judge from the stocks on hand throughout the state. Persistent fall rains have left many road contracts in New York uncompleted. J. E. Carroll, president of the Association, held the chair, with John G. Carpenter as secretary.

Everything considered, the attendance was fair and there was no lack of interest or enthusiasm. The subjects discussed were those of real importance to producers and the diescussion was such that it would promote definite action on all points.

Notes from the Meeting

It was reported at the meeting that George Dulin, former manager of the Neil F. Ryan gravel plant at Schenectady, had gone into a mining enterprise.

H. F. Stelley has left the Valley Sand and Gravel Corp. and has gone with the Buffalo Gravel Corp.

A new plant is expected to be built at Sherburne by J. F. Paddleford, road contractor.

Nathan Oaks and son, of Oaks Corners, have acquired land that will permit locating their plant on the N. Y. C. R. R.

An increased use of "No. 1" gravel as an oil blotter was reported, also the use of "No. 2" gravel for repairing macadam roads.

Prof. Whitnall of the Madison Sand and Gravel Corp., has been elected assemblyman.

Whitney Bros. to Build New Dock and Screening Plant

CONSTRUCTION of a dock at the foot of 21st avenue W. with a capacity of more than 50,000 cu. yd. of sand and gravel was announced recently by Gwin Whitney, president and general manager of Whitney Bros. Co., Duluth, Minn. It was also announced that plans are being prepared for the building of a large screening plant to handle gravel, sand and crushed rock at the same location.

The dock and plant will be the largest owned by the Whitney Bros. firm and will become the distributing headquarters, working in conjunction with their two plants in Superior. The firm is drawing its own specifications and plans for the new gravel and sand plant and will have them completed by the first of the year.

Work on the dock has been progressing quietly for the last two months, but formal announcement of the project was withheld. The firm leased the bay frontage for a long term of years, having previously stored their sand and gravel on the property east of the old 21st avenue wharf. New railroad tracks have been built into the plant, thus providing transportation facilities.

The dock extends 500 ft. into St. Louis bay and required 150,000 sq. ft. of dirt for the filling work. Dredges have also been constantly at work dredging out the newly constructed slip which is 125 ft. wide and 20 ft. deep. This will enable ships, common to the Great Lakes, to load and unload cargoes at the dock.

The Whitney company now has two plants in Duluth and two in Superior, Wis., with a total annual output of 400,000 cu. yd. of sand and gravel. Headquarters are maintained at 909 Alworth building, Duluth, with sales offices at Ashland and Superior, Wis., and Port Arthur, Ont., Can.—*Duluth (Minn.) News-Tribune.*

Texas Sand and Gravel Output 6,000,000 Tons in 1925

THE sand and gravel mined and shipped in Texas during the year 1925 amounted to a total of 6,093,476 tons, valued at $3,478,-517. These statistics have been obtained by the Bureau of Economic Geology, University of Texas, in cooperation with the United States Bureau of Mines. The sands used in Texas include glass sand, molding sand, and sand for concrete and mortar, as well as for other miscellaneous purposes. The gravel used is for concrete and mortar, road paving and railroad ballast. During the year a mining enterprise has been inaugurated, utilizing the green sand in Bexar county, near San Antonio. The principal mineral in green sand is glauconite, which is a silicate of iron and potassium, containing also a small amount of phosphorus. The potassium and phosphorus when in soluble form are fertilizer constituents. Water softening and soil neutralizing properties are also claimed by the operators for the Bexar county green sand, it is stated.

Elkhart Sand and Gravel to Erect Large New Plant

WE are officially informed that the Elkhart Sand and Gravel Co. of Elkhart Lake, Wis., is planning the erection of a complete new washed sand and gravel plant within the near future. When ready for operation, the capacity of the new plant, it is stated, will be 25 cars per day. Belt conveyors will be used to convey the material from the pit to the screen.

The Balkstad Machinery Co. of Elkhart, Ind., are the construction engineers. Peter Kramer, who is superintendent of plants, will supervise building operations.

Officers of the Elkhart company are: A. A. Laun, president; A. A. Raeder, vice-president; Lester L. Laun, secretary-treasurer, sales manager and purchasing agent; Peter Kramer, general manager.

Get Your Certificate!

THE NATIONAL SAND AND GRAVEL ASSOCIATION has secured the consent of the railroads to use the certificate plan in connection with its Cincinnati convention entitling those who attend the convention to one-half of the regular return fare. Presumably this is allowed only after the filing of a certain number of certificates at the convention. In other years the failure of only a few ticket purchasers to ask for a certificate has barred all the others from the one and one-half fare rate.

This year let everyone remember to ask for a certificate when he buys his ticket.

GET YOUR CERTIFICATE!

Norfolk Company to Extend Operations to Richmond

THE Norfolk Sand and Gravel Co., Norfolk, Va., is about to start hauling sand and gravel on its barges from Richmond, according to the Richmond (Va.) *Leader*. Arrangements were recently completed with the Richmond Chamber of Commerce for the use of the docks and facilities at Richmond.

The company will use a pit about 15 miles below the city on the river, which is considered one of the largest gravel pits in the south. They will haul the gravel to Richmond and ship it by barge from the Rockets.

The company reports that it already has a large number of orders that will be filled from Richmond.

New Company Will Produce Silica Sand in Nevada

THE Nevada-Pacific Minerals Co., according to reports, was recently incorporated under the laws of Nevada for $200,000, for the purpose of producing silica sand. The company is said to own 640 acres of silica sand in Nevada near Las Vegas, on the Los Angeles and Salt Lake branch of the Union Pacific Railroad. The sand in this deposit is claimed to be similar in formation and character of grain (being round grain) to the silica sand at Ottawa, Ill.

Practical tests of the Nevada sand made in steel foundries and glass plants over a period of four years have proven the sand, it is said, to be entirely satisfactory for the company's purpose. Actual tests are said to have proved that flint glass made from this deposit is colorless.

The company, it is also reported, now has plants under way for the immediate construction of a 100-ton plant at the deposit. In the meantime, it has taken over the molding sand properties and plants of the Mineral Supply Co. at Riverside, Calif. This plant produces a light molding sand suitable for small gray iron, brass and aluminum castings and has a capacity of 100 tons per day.

News of All the Industry

Incorporations

Rochester Cast Stone Co., Detroit, Mich., 11506 Russell St., $32,900.

West End Sand Co., Louisville, Ky., $15,000. C. Berger, Dora Berger and F. J. Kelnan.

Wolf Creek Sand and Gravel Co., St. Louis, Mo., $15,000. J. E. Schwarz, 4523 Gibson St.

East St. Louis Stone Co., East St. Louis, Ill., increased capital stock from $20,000 to $50,000.

Victoria Sand and Gravel Co., Victoria, Texas, $22,000. F. S. Buhler, W. B. Dupre and J. L. Dupre.

R. C. Belk Sand Co., Mount Holly, N. C., $16,000. R. C. Belk, Mount Holly; H. J. Dunavant, Bizzle Rd., Charlotte.

Independent Sand and Gravel Co., Omaha, Neb., $50,000. H. B. Waldron, George M. Mangold and Clement L. Waldron.

Ralph Sand and Gravel Co., Brooklyn, N. Y., $10,000. Louis Di Fonzo, Carl A. Kahn, George A. Ostergren.

Southern Limestone Co., Harriman, Tenn., $60,000. L. O. Scott, J. N. Baker, J. E. Rodes, F. T. Sanders and W. C. Anderson.

Klinker Sand and Gravel Co., Seattle, Wash., $25,000. J. C. Klinker, Philip Neary and Edwin Neary.

Southern Paint and Pigment Co., Doyle, Tenn., $50,000. W. F. Ward, J. M. Gamble and others. To manufacture crushed lime and paint pigments.

Wilbus Cement Co., Inc., Duluth, Minn., $50,000. To manufacture cement products. C. P. Wilbus, 3073 Restormel, and others.

Newark Mirror Brick Corp., Newark, N. J., $250,000. Theodore P. Feury, Margaret A. Feury, Frank Carpenter, Paterson. Attorney, Benjamin N. Semilef, New York City.

Eau Claire Sand and Gravel Co., Eau Claire, Wis., increased capital stock from $150,000 to $200,000. President, J. J. Kelley, Sr.; A. C. Ayres, secretary.

Wabash Sand and Gravel Co., Terre Haute, Ind., increased capital stock from $40,000 to $100,000, said increase of $60,000 being preferred stock.

Glenn Rock Concrete Products, Inc., Jamesburg, N. J., $50,000. R. Glenn Davidson, Samuel L. Good, Sr., Samuel L. Good, Jr., Jamesburg. Attorney, John P. Kirkpatrick, New Brunswick.

American Portland Cement Co., Camden, N. J., $500,000. F. R. Hansell, A. Celeow, John A. MacPeak, Camden. (Filed by N. J. Corporation Guarantee and Trust Co., Camden.)

Corbetta Concrete Corp., New York, N. Y., $25,000. E. A. Marmor, B. Lieberson, I. E. Reissick. (Filed by Kadel, Van Kirk & Reynolds, 2804 Third Ave.)

Diamond Crushed Stone Corp., Asheville, N. C., $150,000; $50,010 subscribed by Dawson and Virginia Wylly of Biltmore and Helen Marsak, New York City. To quarry rock and stone and deal in building material.

Woodland Sand and Gravel Co., Newton, Mass., $50,000; 500 shares $100 each. Amato Pescosolido, Cataldo Marchioni, Filomena Pescosolido and Carmelt Marchioni, all of Newton. Stone, rock, gravel, etc.

Quarries

Walker Bros., Stoufferstown, Penn., are reported to have purchased the equipment and business of the Chambersburg Stone Co., whose quarries are located just east of Stoufferstown and have been in operation for the past three years.

Escondido, Calif.—Increased building activities on the Pacific coast have resulted in such a heavy demand for stone that two quarries located in Spook's Canyon, near here, are reported to be preparing to speed operation of their plants. John Stridsburg, owner of Crystal Black Diamond quarry has purchased a compressor, it is said, and is planning the installation of other electrical equipment. W. W. Walker, who is declared to have recently become entire owner of the Ebony Black Diamond quarry, is contemplating the installation of a large compressor and stone cutting saw. Walker is said to have bought a half interest in the mine from T. W. Stockdale, his former partner.

Coast Rock and Gravel Co., Oroville, Calif., will close its plant for the winter months, during which time the plant will be overhauled and put in condition for next spring.

Weston & Brooker Co., Columbia, S. C., has finished the reconstruction of its crushed stone plant, at a cost of about $100,000.

Basalt Rock Co., Inc., Napa, Calif., is reported to be so rushed with orders that they are working day and night shifts to keep up with the demand. Albert Streblow is superintendent.

Sand and Gravel

A. M. Wilder, Wichita, Kan., is reported to be contemplating developing a gravel pit on 40 acres of a 120-acre tract of land he purchased recently from Wesley Greeson, a local man. The 40 acres in question are located along the banks of the Little river.

Globe Construction Co., Wichita, Kan., recently acquired three acres of land along the Little river for $4,500 for the purpose, it is said, of developing the gravel pit on the property.

Valley Sand and Gravel Corp., Rochester, N. Y., were hosts to members of the Rochester Engineering Society recently at both their Wadsworth and Canawaugus plants. Luncheon was served at the latter plant.

Ross Island Sand and Gravel Co., Portland, Ore., is reported to have awarded the contract for a gravel bunker to cost $10,000 to the Baker Construction Co.

Leonard Gravel Co., Lansing, Mich., are now said to be working four pits to keep up with the local demand for sand and gravel. The offices of the company are located at 311 E. Mt. Hope Ave.

Dubuque, Iowa.—The Dubuque County Board recently authorized the purchase of a two-acre tract of land on the Christopherson farm in New Wine township, it is reported, for the purpose of furnishing gravel to finish surfacing the Vienna-Luxemburg road.

Princeton, Ill.—The Princeton board of supervisors are said to have purchased a portable gravel screening and crushing plant recently from the Iowa Manufacturing Co. of Cedar Rapids, Iowa, to be used in surfacing the gravel roads throughout the county.

West Point Gravel Co., operating a large plant near Smithville, Texas, has installed electric power in operating their establishment and have so increased their business that they are now operating night and day crews. A large three-cylinder crude oil engine is being utilized for running a 100-kw. generator from which a steady flow of current is obtained.

Wolf Creek Sand and Gravel Co., Delight, Ark., is said to now have 97 acres under development, with an estimated output of 400 to 500 yd. per 10-hr. day. Equipment has been purchased. John E. Schwarz is secretary.

Rodgers Sand Co., Pittsburgh, Penn., recently completed its new modern dredge, the Captain, which has been under construction for some time, and placed it in service, according to reports. The dredge was built by the Dravo Contracting Co.

Lime

St. Joe Lime and Stone Co., Little Rock, Ark., is reported to have the work of rebuilding their plant, which was damaged by fire a short time ago, well under way. A new ledge has been opened in the quarry, and new machinery is being installed.

Sand Springs Lime Co., Sand Springs, Ark., will erect a new lime plant, according to reports.

S. W. Barrick & Sons, Woodsboro, Md., will rebuild their recently burned lime plant and install latest improved machinery.

Peoples Lumber Co., Ventura, Calif., has begun the construction of a lime bin on Front St., to cost $1500.

Cement

Universal Portland Cement Co., Chicago, Ill., entertained 200 members of the Illinois Manufacturers' Association at their Buffington, Ind., plant recently. B. F. Affleck, president of the cement company, made a short talk to the manufacturers.

West Penn Cement Co., Butler, Penn., which is constructing a $2,000,000 plant at West Winfield, has just let the contract for installing electricity in 70 houses that are being erected for employes, according to reports. It is expected that the plant will be ready for production about the first of the year.

Warrior Cement Corp., Chattanooga, Tenn., has been awarded the contract for furnishing cement for work on the Ponchartrain bridge, which crosses Lake Ponchartrain between New Orleans and Slidell, La., and is approximately six miles in length. The contract calls for 140,000 bbl. of Warrior portland cement, and was placed by the Raymond Concrete Pile Co. of New York.

C. A. Brockett Cement Co., Kansas City, Mo., recently increased their holdings, according to a report, by purchasing a two-story brick building and ground at 1405 Walnut St. Plans for the use of the new building have not been divulged as yet. Howard McCutcheon is president of the company and Robert M. Brockett, vice president.

Lawrence Portland Cement Co., Northampton, Penn., according to reports, is completing plans for initial buildings for its branch mill on the site recently acquired at Thomaston, Me., to cost in excess of $1,200,000 with equipment. The main plant of the company is at Siegfried, Penn. Frank H. Smith is president.

Alpha Portland Cement Co., Chicago, Ill., is planning the construction of a five-story addition to its branch mill at Continental, Mo., it is said. The estimated cost of the plant, including equipment, is $80,000. C. N. McClarnem, La Salle, Ill., is chief engineer.

Phoenix Portland Cement Co., Inc., Birmingham, Ala., is reported to have their new plant at Powderly, now under construction, very near completion. The plant will represent an investment of around $2,000,000 when completed.

Alabama Portland Cement Co., Birmingham, Ala., will hereafter use bags made of cotton cloth in packing cement, rather than burlap bags, it is reported. This is in accordance with a plan to encourage the consumption of cotton. Other cement plants of the district are expected to join in the movement.

Cement Products

F. M. Ballou Co., Providence, R. I., is said to have had complaints filed against them again by property owners located near the concrete works. Objections regarding the way the plant is operated were brought up by residents in the neighborhood for the first time two years ago.

C. A. Lyon has engaged in business at 1193 Union Ave., Portland, Ore., as the Oregon Concrete Products Co.

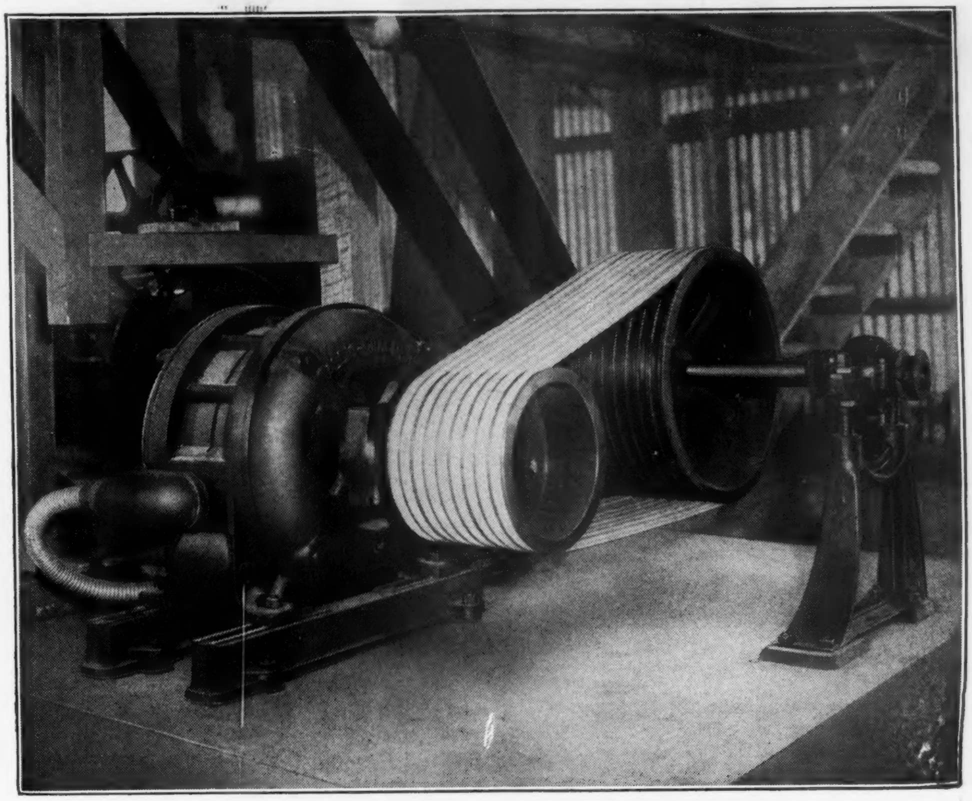
Concrete Products Co., Salina, Kan., of which H. H. Allison is owner, is taking bids on construction of a two-story plant at 1101 West Park.

California Concrete Products Co., San Carlos, Calif., is reported to now have its plant under construction. The plant will be served by the Southern Pacific railroad.

Newman Cement Block Co., Whitesville, N. J., reports the loss by fire of its one-story cement block manufacturing plant on Myrtle Ave. The roof burned through and the interior was completely wrecked. The loss was placed at $14,000 by Charles Newman, owner of the company. A new building, it is said, will be erected to replace the destroyed plant.

Butlerville Cement Products Co., Butlerville, Ind., is reported to have recently filed certificate of final dissolution with the secretary of state.

Shearman Concrete Pipe Co., Inc., Knoxville, Tenn., has found it necessary, it is said, to erect a temporary outfit on leased ground at Miami, Fla., for the manufacture of a large quantity of



100 H. P. Texrope Drive with Allis-Chalmers induction motor

pipe for the city of Miami. At an early date, however, they expect to select a site on which they will erect a permanent plant to serve the Miami district, as announced in the November 13 issue of ROCK PRODUCTS.

Seattle, Wash.—The Northwest Concrete Products Association will hold a convention January 21 and 22 in this city, to which all who are interested in concrete products are welcome. The association was formed one year ago and has a membership which includes 41 active plants, manufacturing every type of concrete products. The membership consists principally of men engaged in the concrete industry in Oregon, Washington and Idaho.

Gypsum

U. S. Gypsum Co., Chicago, Ill., reports that plants are under way for increasing the company's facilities at Kansas City, Mo., by building a 1 and 2 story plant. A sub-contract has been awarded, it is said, to the Bickel Construction Co., 903 Pioneer Trust Bldg., Kansas City, at an estimated cost of $500,000.

Rock Phosphate

J. J. Nelligan, president, Safe Deposit and Trust Co., Baltimore, Md., is said to have purchased the Jane Jay mine of the Peninsula Phosphate Co. located near Fort Meade, Fla., in the interest of bondholders. The property consists of 600 acres of phosphate land, buildings and machinery. A new company will probably be formed later, according to reports.

Miscellaneous Rock Products

Asbestos Shingle, Slate and Sheathing Co., Ambler, Penn., is stated to have awarded a general contract to the Fruin-Colon Construction Co., St. Louis, Mo., for the $100,000 one-story branch plant it is building on property recently acquired.

Portland-Monson Slate Co., Portland, Me., who recently lost their plant by fire, plan, it is reported, to acquire new quarters at an early date. Lifting and miscellaneous machinery will be required.

Carolina Roofing Tile Co., Newberry, S. C., of which G. S. Leslie is manager, has its 25x52-ft. plant under construction and will have a daily capacity of 1200 head-lock roofing tile.

Kansas City Duntile Co., 34th and Roanoke Rd., Kansas City, Mo., of which C. Williams is president, plans construction of a plant next spring near 85th and Holmes St.

Heinrich Hoeppner has sold the Tile Manufacturing Co., 2726 First St. South, Seattle, Wash., to F. Barkshire and others.

Birmingham Slag Co., Birmingham, Ala., is reported to be rebuilding its screening plant at Alabama City which was recently destroyed by fire. The new structure will be of steel construction.

Personals

Miss Sarah Arnoll, who for many years had charge of sales for the Longview Lime Works and the Saginaw Lime and Stone Co., both at Longview, Ala., recently severed her connections with these companies and is now said to be with A. A. Adams & Co., a Birmingham real estate and insurance firm.

F. M. Sackett, U. S. senator from Kentucky, and member of the interests operating the Louisville Cement Co., Byrne & Speed Co., etc., left Louisville on November 6 for Washington, where he will spend the winter, after working hard in the political campaigns in Kentucky over the election period. Senator Sackett is vice president of the Louisville Cement Co.

E. LeRoy Harrington, clamshell bucket engineer and designer, is now a member of the Blaw-Knox Co., Pittsburgh, Penn. Mr. Harrington will be engaged in the development and design of special buckets for use at loading and unloading docks, blast furnaces and elsewhere where suitable clamshells are needed for special service.

Burton L. Delack, assistant manager of the Erie, Pa., works of the General Electric Co., has been appointed assistant manager of the Schenectady, N. Y., works, effective December 1, 1926. At the same time John St. Lawrence, general superintendent at Erie, has been named to succeed Mr. Delack there.

Manufacturers

William Ganschow Co., Chicago, have appointed Harold D. Mitchell sales representative in the western half of New York state, with headquarters at 1543 Fillmore Ave., Buffalo, N. Y.

Blaw-Knox Co., Pittsburgh, Penn., announce the addition of E. J. Costello, Jr., to their sales staff to cover the territory adjacent to their Philadelphia office.

W. W. Sly Manufacturing Co., Cleveland, Ohio, have received an order for a large dust arrester and complete equipment for the bagging machines at the plant of the South Australian Portland Cement Co., Brighton, South Australia. The Sly company in the past year have shipped dust arresters to cement plants in Cuba, Argentina, New Zealand and Norway in addition to the above unit.

Botfield Refractories Co., Philadelphia, Penn., announce the following new distributors: Curtis Supply Co., Inc., Washington St., Buffalo, N. Y.; Waldreth Supply Co., 707-711 Cherry St., Des Moines, Iowa; South Side Foundry and Machine Works, Charleston, W. Va.; Empire Machinery and Supply Corp., 409-411 Water St., Norfolk, Va.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Silent Gears. Bulletin **GEA-482** on Textoil and Textolite gears. Application data, capacity tables, illustrations and details of construction and design. GENERAL ELECTRIC CO., Schenectady, N.Y.

Centrifugal Pumps. New and revised edition of the Cameron single stage, double-suction, volute pump bulletin No. 7059. Details of construction and data on design, capacities, etc. INGERSOLL-RAND CO., New York, N. Y.

Hydraulic Dredge Machinery. Bulletin No. 125 illustrating and describing sand and dredging pumps, power equipment and accessories for hydraulic dredges, etc. Includes a discussion on prevalent methods of sand and gravel production by dredging, hydraulic conveying at cement plants, hydraulic stripping, and illustrations of many dredges now in operation at different plants. MORRIS MACHINE WORKS, Baldwinsville, N. Y.

Ganschow Gears. Booklet outlining the history of the company. WILLIAM GANSCHOW CO., Chicago, Ill.

Speed Reducers. Lubrication instruction for IXL speed reducers. FOOTE BROS. GEAR AND MACHINE CO., Chicago, Ill.

Van Guilder Wallbuilder. New catalog illustrating and describing Van Guilder systems and machine for erecting buildings with double monolithic walls. Operation details, prices, etc. VAN GUILDER SYSTEM, New York, N. Y.

Bauxite in the United States

THE bauxite deposits of the United States are in central Arkansas, northeastern and southeastern Alabama, northwestern and west-central Georgia, northeastern Mississippi and eastern Tennessee, states the Bureau of Mines in a recently issued report. The bauxite from all localities in the United States, though it may vary in chemical composition, is on the whole similar in general appearance, with the exception of the "granitic bauxite" of the Arkansas field. The greater part of the American bauxite appears to be made up of rounded pebble-like bodies set in a fine-grained matrix, which may also consist of small rounded particles or may be as fine grained as the finest clay. The pebble or pisolite form is so general that it is the conspicuous characteristic of American bauxite.

There is only one way to determine the value of bauxite, and that is by chemical analysis, which should show total silica, alumina, titanium oxide, iron oxide and water. Bauxites of commercial grade should carry at least 52% of alumina.

Some measure of the relative quality of dried bauxite can be had by grinding a sample in an agate mortar for half a minute. A bauxite of good grade will be found hard to grind and will stick to the mortar with such tenacity that it will have to be scoured out; a poor bauxite or bauxite clay will grind much more easily and will stick very little, if at all; and clay or kaolin grinds with ease and does not stick to the mortar. Similar results are found if the sample is rubbed on glass; the glass will not be scratched by even high-grade bauxite.

Bauxite finds its market east of the Mississippi river, and is sold largely to the manufacturers of aluminum, abrasives, commercial chemicals and refractories. In 1925 the market for the manufacture of the alumina cements was largely met by imported bauxite. High-alumina (diaspore) clays produced in Missouri are being sold according to their alumina content, and three grades, containing 55, 65 and 70% of alumina, are regularly handled. In the last few years some of the makers of refractories and of aluminum chemicals have been using clays as a crude material in place of bauxite.

The largest consumers of bauxite in the United States are also producers, and there is only a small market for what might be called "outside bauxite," states James M. Hill of the Bureau of Mines, in a report recently issued. Consumers who do not own deposits contract for their supplies for considerable periods, seemingly to assure an adequate supply of bauxite of the grade desired. The price of bauxite at mines or shipping points in 1925, as reported by independent producers, ranged from $5 to $6.41 a ton; the average price reported by all producers for the year was $6.28 a ton f.o.b. mines. Consumers, on the other hand, report prices that average $12.50 a ton f.o.b. plants, a little lower than in 1924.

Crushed bauxite was quoted at $5.50 to $8.50 a ton throughout 1925. Dried and pulverized bauxite was quoted at $14, and calcined bauxite at $19 to $20 a ton f.o.b. shipping point. French and Adriatic bauxite was offered at $4 to $7 and Guiana at $8.50 c.i.f. American ports.

Under the tariff act of 1922, crude bauxite is dutiable at the rate of $1 a ton, and alumina hydrate or refined bauxite at half a cent a pound.

Investigation Into Improved Milling of Fluorspar Ores

AN investigation to determine possible improvements in the milling of fluorspar is being conducted at Rolla, Mo., by the Bureau of Mines, Department of Commerce. A study has been made of tailings from concentrating mills in southern Illinois, and the material was subjected to experimental classification, and concentration with jigs and tables in order to determine its behavior. Sufficient progress has been made to indicate that considerable improvement in concentration and more economical recovery may be effected.